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ECOSTRUXURE FOXBORO USER GROUP 2018

The editors of Control report on breaking news and session highlights

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Schneider Electric

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WORLD'S LARGEST PETROCHEM COMPLEX RELIES ON SCHNEIDER

By Jim Montague

If you still think everything's bigger in Texas, it's only because you haven't yet visited Reliance Industries' gigantic Jamnagar refinery and petrochemical complex in Gujarat, India.

The huge facility can refine about 1.24 million barrels of oil per day, which is reported to be more than any other single location in the world. Its two main refineries, J1 and J2, opened in 1998 and 2006, respectively, and were joined in 2016 by J3, a 30-square-kilometer, greenfield facility that includes:

- World's largest refinery off-gas cracker;
- World's largest gasification complex;
- World's largest paraxylene (PX) manufacturing complex; and,
- Mono-ethylene glycol (MEG), low-density polyethylene (LDPE) and ultra-low-density polyethylene (LLDPE) plants.

Jamnagar's two initial mega-refineries and latest petrochemical complex are integrated with multiple mesh communications networks. The J3 complex also employs:

- 300,000 serial I/O;
- 113,000 hardwired I/O;
- 30,000 Foundation Fieldbus (FF) instruments;
- 8,000 FF network segments;
- 3,000 cabinets;
- 450 Schneider FCP 280 controllers; and,
- 250 operator workstations.

Because Jamnagar covers such a vast area and scattered applications, it's vital to transfer data efficiently among field devices, remote control locations and central data processing and control locations, according to Upendra Joshi, engineering discipline head for C&I at Reliance.

"If we can get data sent in, or find and fix a control system remotely, it's better than going out to the field," said Joshi. "About 63% of maintenance time is spent investigating problems that don't exist. Remote diagnostics over a fieldbus network can tell us this, so it's no longer be necessary to check reports, and we can avoid unnecessary trips to the field."

Joshi and B.R. Mehta, senior vice president at Reliance, presented "Deployment of new technologies in J3 projects" at the Foxboro User Group conference this week in San Antonio.

Coordinated control rooms

Beyond its FCP 280 controllers, the J3 facility also features Schneider Triconex safety controllers, V90 virtualization servers, primary and secondary domain controllers, and a customized networking solution that Schneider developed exclusively for Reliance to let Jamnagar's seven mesh

"We have to see each control room at J1, J2 and J3, so we can balance production between them. It's a major task if they aren't balanced correctly." Reliance Industries' B.R. Mehta, together with colleague Upendra Joshi discussed the challenges inherent in a major new expansion at the company's Jamnagar complex in Gujarat, India.

networks communicate with each other. The company has even developed a super-site supervisor job description to oversee and maintain these crucial communications.

"We have to see each control room at J1, J2 and J3, so we can balance production between them," explained Mehta. "It's a major task if they aren't balanced correctly."

"We're the first to implement these technologies on such a large scale," added Joshi, who reported that Reliance's expectations of Foundation Fieldbus include: interoperable products and systems; elimination of proprietary protocols; innovation from FF-enabled suppliers; more detailed device diagnostics; reduced installation costs; more information from valves; multiple inputs from single devices; ease of adding instrumentation later; reduced wiring, terminations, commissioning time and control room space; better instrument diagnostics and more control in the field.

Building on Foundation Fieldbus

"We need solutions like Foundation Fieldbus because there's still room for improvement in many process applications and networks," explained Joshi. "About 20-40% of control loops are still manually controlled, 80% of control loops demonstrate excessive process variability, and many benefits from possible advanced process control are being missed."

J3 also implemented an asset management system that is compliant with NAMUR'S NE 107 guidance on "Self-Monitoring and Diagnosis of Field Devices," and has gained several benefits from doing so. "The centralized asset management system provides one easily accessed window to the most up-to-date information about its asset conditions plantwide," said Joshi. "These include insight into the health and performance of physical assets, awareness of undesirable conditions, and triggered, targeted actions to respond proactively to emerging problems.

"In addition, maintenance teams are provided with early visibility and insight into asset conditions to drive a proactive maintenance approach that maximizes operational efficiency by preventing disruptive and costly unplanned downtime, reducing the time to identify problematic assets, shortening planned turnarounds, and streamlining maintenance workflows and productivity."

Similarly, Joshi added that control in the field gives J3 reduced loop dead time, 5-15% faster loop response, reduced system costs, 5-15 % more loops or field devices on a segment at an equivalent macro cycle, and reduced controller/processor loading. "In addition, our operators can now see colors and shapes on their displays that indicate right where problems are happening."

"Completing a project like this was a very big task," added Joshi. "So it was lucky we had a supplier like Schneider Electric that was willing to work day and night with us."

Mehta added his gratitude for Schneider Electric's ongoing assistance on J3 and beyond. "The best philosophy is to keep a happy mind," he said. "We don't know if success brings happiness, but a happy mind will lead to success."

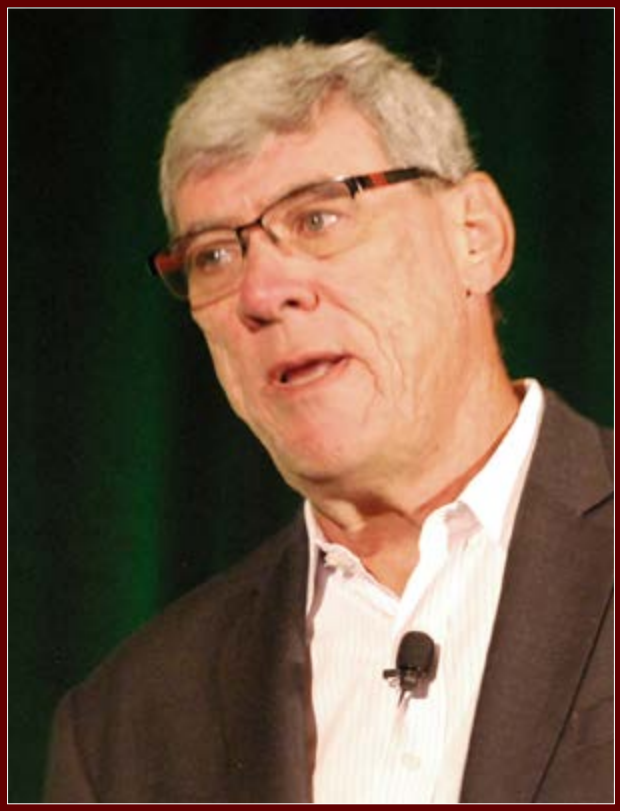
SCHNEIDER ENABLING REAL-TIME PROFITABILITY CONTROL

By Keith Larson

As the pace of business continues to accelerate in lockstep with seemingly exponential digital innovation, Schneider Electric is uniquely positioned to safely drive measurable operational profitability improvement on behalf of its process industry customers. Such was the message delivered by Gary Freburger, president of the company's Process Automation business, in his kick-off address to attendees of this week's Foxboro User Group conference in San Antonio.

Indeed, the company's EcoStruxure Plant portfolio encompasses everything from instrumentation to edge devices (such as controllers) to a broad range of applications,

"Our customers are asking us to understand the full value of their automation investments, not just at the project phase but throughout an asset's lifecycle." Schneider's Gary Freburger is bullish on the integration of the company's EcoStruxure Plant platform with AVEVA design tools to deliver unique lifecycle advantages.



analytics and services. "But the real measure of these technologies is how well we turn them into something meaningful for you," Freburger said.

Central to the Schneider value proposition is the disciplined conversion of variables that once could only be managed into real-time control domains. "For example, asset performance management is an important function, but this traditional term entails a reactive approach," Freburger said. Instead, the company proposes that its customers do asset performance control.

"It's a new approach to asset performance and represents a shift to real-time control across your entire value chain." These other value-chain parameters include efficiency, reliability, safety, security and—ultimately—profitability. "We have an unprecedented portfolio. But even more importantly we can close the loop on all of this," Freburger said. "At the end of the day, it's all about how can we help you drive profitability and better return on investment."

Lifecycle integration

Another key differentiator of the Schneider offering is the integration of its EcoStruxure Plant platform with the plant design software tools of Schneider-controller sister company AVEVA. This integration allows the company to holistically address both capital expenditure (CAPEX) and operational expenditure (OPEX) implications of design decisions early on and throughout a plant's full lifecycle. "It's a TOTALEX view," Freburger said.

"Our customers are asking us to understand the full value of their automation investments, not just at the project phase but throughout an asset's lifecycle," Freburger said. Other key demands include ensuring the security of the entire system and facility, the support of system performance support, empowering the workforce to drive value, measurably improving operational profitability while ensuring safety, and showing the value of the Industrial Internet of Things (IIoT) and digitalization.

"Our vision is that your industrial automation investment will become the profit engine of your business," Freburger said. "Digitalization activates and empowers you to drive business value, and the EcoStruxure Foxboro DCS will continue to evolve as our next-gen solution for real-time efficiency, reliability, safety and profitability control."

"Our vision is that your industrial automation investment will become the profit engine of your business."

SCHNEIDER ELECTRIC HELPS TO REVIVE MEXICAN POWER-PLANT PROJECT

By Paul Studebaker

The economic roller coaster of recent years has presented threats as well as opportunities for engineering and construction companies. Tough times have been especially difficult in countries and for companies that depend heavily on a limited range of industries. So, when financial difficulties made it impossible for Abengoa, an engineering-and-construction (E&C) company, to complete Norte III, a 907 MW combined-cycle power-generation plant in northern Mexico, Techint Engineering & Construction had strong incentive to try to pick up the pieces.

Norte III is an independent power project (IPP) led by Federal Electricity Commission (CFE), the state-owned electric utility in Mexico. The Norte III IPP hired Abengoa to finance, build and operate the power plant for 25 years. Techint was bound by the original IPP.

"Rebidding would have caused an unacceptable delay. We offered to renegotiate the loans and suppliers, and finish the project," said Pedro Gutiérrez, commercial director, North America, Techint Engineering & Construction. "It took 1-½ years to renegotiate. With many of the suppliers effectively in Chapter 11, it was very difficult.

"At Techint, we say any project that doesn't die a couple of times is not a real project. This project died three times—the most difficult project we've ever approached."

Gutiérrez spoke to attendees of his session, "Control solution to combined cycle power generation plant Norte III," at the Foxboro User Group conference this week in San Antonio. Techint Engineering & Construction was founded 74 years ago in Italy, and it is now headquartered in Argentina with offices in 150 countries. With strengths in energy, mining and metals, it has completed 3,500 projects, currently has 24 in progress and is on track to reach $3 billion in revenue in 2018. "Our focus on safety, environment, standards and respect for local legislation sets us apart from others," Gutiérrez said.

Norte III renegotiations

Along with simply wanting the work in lean times, Techint saw Norte III as an opportunity to position itself as an engineering, procurement and construction (EPC) contractor and developer in the power-generation market. To do this, it would have to deliver, per the original Abengoa contract, one 907-MW combined-cycle power plant to supply more than 500,000 homes and cover an annual energy growth demand of 3.6% per year.

The plant includes four gas-fired and two steam turbines, all made by GE. The turbines use Schneider EcoStruxure Foxboro controllers and HMIs. "Based on our experience,

"At Techint, we say any project that doesn't die a couple of times is not a real project. This project died three times—the most difficult project we've ever approached." Techint's Pedro Gutiérrez explained the resuscitation of a combined-cycle power plant project at the 2018 Foxboro User Group conference in San Antonio.

it's clear that Foxboro controls are an improvement over GE's," said Gutiérrez.

CFE expected a transparent EPC change from Abengoa to Techint, so Techint needed to minimize engineering, commissioning and startup time, to leverage partnerships with experienced suppliers that have local execution capabilities with installed-base experience and, of course, to deliver a competitive price.

"CFE could not renegotiate any prices with us; we had to keep the exact same figures. We could only negotiate the schedule," said Gutiérrez. "It took months to review the Abengoa engineering work, which we found to be good. We renegotiated 47% of the loans and found new ones. We renegotiated 156 agreements with suppliers, including Schneider Electric."

Schneider Electric had been selected by Abengoa. A world leader in safety, process and reliability control, the company also has experience in combined-cycle power plants in Mexico. It has a good reputation in project work and is a trusted vendor to CFE.

"We took over the negotiations and presented tough conditions. Schneider worked with us," said Gutiérrez. "They offered a better price than their competitors and included added value based on IIoT."

More than a control system

The control solution includes apps, analytics and services, edge control and connected products delivered via EcoStruxure Plant, which also handles GPS synchronization, sequence of events (SOE) and remote communication with the country's National Electrical Center (CENACE). An EcoStruxure Foxboro DCS uses the company's high-availability mesh control network to connect FCP 280 controllers, Compact 200 Series I/O modules and fieldbus modules for distributed network protocol (DNP3), IEC-61850 and Modbus TCP/IP communications. It also integrates third-party wired and wireless communication protocols.

Factory acceptance testing (FAT) involved two processor cabinets, one server cabinet, 18 remote cabinets, one third-party integration cabinet, seven operator stations, one engineering station, two historical servers and one web server. The hardware FAT has been successfully completed, and the software FAT is in progress. Gutiérrez said, "The project is now 65% done and will finish at the end of next year."

Gutiérrez praised Schneider Electric's response to the challenges of Techint's contract, which included an aggressive equipment delivery schedule (six months) and plans for a startup early in 2019. "Schneider Electric has vast experience in combined-cycle power plants in Mexico, and they are trusted by CFE, which used to also produce electric power," he said. "Compared to competitors, we see Schneider Electric as providing a different level of technology and support."

HOW INDUSTRY WILL PROFIT BY DIGITALIZATION

By Paul Studebaker

Digitalization has been around for 40 years, so why are we talking so much about it now? It's been a force behind huge improvements in productivity, "But, along the way, it's gone from the means to an end to an end itself," said Peter Martin, vice president, innovation and marketing, Schneider Electric, in his plenary session at this week's Foxboro User Group conference in San Antonio, Texas. Today, "It's reached a point where we can stop focusing on the technology itself, and start focusing on profit.

"When we began applying computers in control systems, I was brought from data processing to control, where we

"We can see the profit impact of everything done in the plant, and by the way, we can show that engineers drive profitability by measuring it and making it visible." Schneider's Peter Martin on the bottom-line benefits of real-time profitability control.

would use control engineers to solve problems, then use computers to implement the solutions. Digitalization changed control—the language went from PID and cascade to bits and bytes, and the perspective of the industry went from solutions-driven to technology-driven. Call it an expert system and it will sell, it didn't matter if it solved a problem.

"We had to focus on the technology because it was so complex. Now the technology is established to the point where we can return our focus to solving problems. We can go from 'Connect everything together and something good is bound to happen' to defining and solving problems."

Business problems are moving from transactional—the IT world—to real-time, the domain of operations technology (OT) and control systems. For example, the costs of energy and materials used to be fixed by contracts for months or a year.

Now, the prices of electricity and oil change every five to 20 minutes, depending on where you are. The prices of metals change once or twice a minute. "You can't control profitability on a monthly basis when critical costs change every 15 minutes," Martin said. "As a result, our job changes. We're the ones who control in real time. We understand it, we can make it happen."

A whiteboard moment

The designs of present-day DCSs, PLCs and controllers date back to the 1970s. They are computer architectures imposed on a plant. The focus has been on making control systems less expensive, to do the same job for less, Martin said. "But there's tremendous amounts of value to be gained using them instead to drive value by activating operations," Martin said. To do this, "We erase the whiteboard and reimagine the control system."

Value is driven by functionality, not the platform. "Greg Shinskey once told me that there's two kinds of control: automatic and manual," Martin said. We've always tried to minimize manual control, but instead, "We can get the workforce into the control loop to drive operational profitability."

Operational profitability depends on obtaining the most value from the plant assets. To use operations to drive asset performance safely and reliably, we must converge the process-centric view of the control system with the asset-centric view of maintenance, Martin said.

"We can maximize value by using operations to drive the process for profitability while balancing the risks of reliability, safety and cybersecurity," Martin said. "We can use technology to make every asset self-optimizing, to maximize its performance and monitor its condition. We can model reliability risk, and control it."

For example, one can see reliability issues and respond by adjusting operations to extend time to failure, and schedule production to allow planned maintenance. Similarly, one can model safety and environmental risk with reliability and consequence factors, determine cybersecurity risks, and control them.

One can also measure and control profitability in real time, Martin said. "We can see the profit impact of everything done in the plant, and by the way, we can show that engineers drive profitability by measuring it and making it visible," Martin said. "Some people say the heyday of the control engineer was in the 1960s and 1970s, but Shinskey told me, it's still coming."

In this model of advanced control, profitability becomes the primary loop in cascade control, constrained by reliability, safety and efficiency. "In the past, we might do theory of constraints with one optimization," Martin said. "Now we have the power to do all the constraints at once."

APM in real time

At today's speed of business, plant operators can't wait for decisions to come down from the C-suite. Meanwhile, operators are reading newspapers, waiting for exceptions. When they make changes, they do them without advice or feedback. "They don't know better," Martin said. Instead, "Give them information about the impact on profitability. When they can see that advanced control and optimization systems improve profitability, they won't put them in manual. If it's working, they'll keep it on."

Martin showed how a profitability information system on the steam generating facility at a Sasol plant is saving $6 million per year simply by showing operators the cost impacts of their control decisions. "A DCS is also a learning system, providing feedback to the operators," Martin said.

It's not sufficient to use ERP information to make profit measurements, as ERP numbers are averaged over time. "You need to measure at the cost point in real time. Then you have very accurate costs," Martin said. "We started by adding real-time accounting models to the DCS, but that's a slow process. It might take six weeks to analyze an application, review the sensors, and implement the system. Now we can build it into the DCS and controllers."

Process historian data can be used to determine the potential benefit by back-calculating the potential savings. "Along the way, we can find optimized operations and golden batches," Martin said. "We can see the effects and optimize the timing of catalyst changes and heat exchanger maintenance, for example."

EcoStruxure Profit Advisor offers industry-specific plug-ins that can be quickly customized to a specific plant. "This reduces a six-week process to perhaps two days," Martin said. Profitability can also be predicted using simulation and a digital twin, he added. "Operations can put a proposed change into the simulator and fast-forward to see its future effect before they decide to implement it in the plant."

Asset performance management is a valuable concept. "Now we're moving it to the control domain to do it in real time for safety, efficiency and reliability," Martin said. The result is "a profit engine for industry. Your industrial automation investment will become the profit engine of your business."

RECOVERY BOILERS BENEFIT FROM MULTIVARIABLE CONTROL

By Paul Studebaker

"The heart of a paper mill is the recovery boiler. It must run well for the mill to run well," said Andrew Jones, senior engineering fellow, International Paper. The boiler provides power, steam and recovery of chemicals, and it reduces the toxicity of black liquor by burning it, with efficient recovery to steam. "But if it's not done correctly, the boiler fouls, plugs up and may shut down the mill for several days."

Jones spoke to attendees of his session, "Comparison of recovery boiler rate control strategies," at the 2018 Foxboro User Group conference this week in San Antonio.

"Boiler control becomes a balance of efficiency and reliability," said Jones, who's worked with various incarnations of Foxboro, Invensys, AVEVA and Schneider Electric systems for more than 12 years, using multivariable predictive control (MPC) and various control schemes.

Jones described four ways to control the flow of black liquor to the burners: volumetric flow rate control, dry solids firing rate control, heat input (steam flow) control and multivariable predictive control.

Volumetric flow rate control

"This is the traditional method, where control is based on upstream and downstream inventories of black and green liquor, with no consideration of the impact on the boiler due to variations in the composition of the black liquor,"

"It's possible to configure multivariable control so that both steam-flow and firing-rate limits are respected." International Paper's Andrew Jones discussed model-predictive rate control at this week's Foxboro User Group conference in San Antonio.

Jones said. Firing conditions may vary considerably with liquor strength (65% to 80% solids, with the balance mainly water). The heating value is not considered, which varies with the species and operating conditions, as well as percent solids, typically 6,000 ±300 Btu/lb. Auxiliary fuel, usually natural gas, may be added as needed to improve stability and boost steam output.

"Volumetric flow rate control carries the risk of overfiring, which can foul and plug the boiler," Jones said.

Dry solids firing rate control

"Many mills have changed over to dry solids firing rate control, and all of our mills run at least this level of control," Jones said. The dry solids firing rate is the product of volumetric flow rate, liquor density and weight fraction of solids in the black liquor solution. Liquor density can be measured online but is typically estimated using an empirical equation where density is a function of liquor temperature and solids fraction. "Dry solids control does well as a green solids inventory control, but you may need to vary the flow to account for black liquor variation," he added.

Liquor strength (percent solids) are taken into account, but the heating value, the organic vs. inorganic solids and the auxiliary fuel are not, so steam output at a given flow rate may vary considerably, and "there is still a risk of overfiring, but it's an improvement over volumetric flow rate control," Jones said.

Heat input control

This strategy is based on steam flow rate, "so it's harder to implement," Jones said. The concept is to control black liquor flow rate on steam rate. It allows the boiler to run closer to its maximum continuous rating (MCR), but it's difficult to implement with simple PID control because of steam header pressure fluctuations and downstream disturbances. "In cases where the black liquor is weak, it can overfeed, which can cause poor flame quality or even a blackout," he said. "So, you may also need a blackout control."

On the plus side, black liquor strength, organic vs. inorganic content and auxiliary fuel are all taken into account, and there is no risk of overfiring, providing limits are set correctly.

Multivariable control

Here, heat input (steam flow) control is implemented with additional variables taken into account, typically firing rate (dry solids). "It's possible to configure multivariable control so that both steam flow and firing rate limits are respected," Jones said. "In a typical configuration, the active limit would be the firing rate, but if the MCR is reached, the controller would keep steam flow at MCR and lower the firing rate."

This control strategy also can allow for the effects of other variables. "For example, on an older boiler with manual port rodding, we were able to control for changes in behavior that happened when the ports were rodded out," Jones said.

To explore the effects of different control schemes on real equipment, International Paper compared efficiency and fouling potential on four boilers before and after implementing multivariable control.

Steam flow control implemented as part of a multivariable predictive controller increases thermal efficiency of a recovery boiler by stabilizing combustion. An increase of 1% to 4% in black liquor-generated steam production

was observed on four recovery boilers. "An increase of 4% in steam flow efficiency easily justifies the cost of the system, even without the increased capacity," Jones said.

Multivariable steam flow control reduces standard deviation of steam production by 10% to 30%, and eliminates MCR excursions except for short transients, which reduces the potential for fouling and plugging, increasing reliability.

On the other hand, "volumetric control does have the advantage of making a consistent droplet size and trajectory," Jones said. "If other, higher-level schemes are having to vary volumetric rates significantly, this could detract from boiler stability. So, it is still good practice to have a percent-dry-solids control loop to reduce the need for large changes in volumetric flow."

THE FUTURE-PROOFED DISTRIBUTED CONTROL SYSTEM

By Jim Montague, executive editor

As its name implies, distributed control is all about going out into process applications and doing control. That's all well and good, until it becomes apparent that the distributed control system (DCS) is being stretched across increasingly varied applications and widely scattered environments. Chief among the solutions taking on new roles to serve them is the EcoStruxure Foxboro DCS from Schneider Electric.

"EcoStruxure Foxboro DCS is a comprehensive portfolio of distributed control capabilities for powering the new digitalized economies," said Alain Ginguene, Schneider Electric's director of global offer management for EcoStruxure Foxboro DCS. "These capabilities cover both capital-expenditure (CAPEX) and operational-expenditure (OPEX) projects, digital-twin simulation initiatives and Schneider Electric services, such as Flexible Execution (FLEX), Intelligent Power and Motor Control Center (iMPCC) and others."

Ginguene presented "Foxboro DCS Technical Outlook and Roadmap" during the opening keynote addresses on the first day of Foxboro User Group 2018 in San Antonio.

"Schneider Electric's approach to CAPEX and OPEX means we don't just ship a product one day, but instead get involved with users starting at the design stage, help them build and commission it, operate and maintain it throughout its full lifecycle, and eventually decommission it," explained Ginguene. "This is where the true value of a complete solution like EcoStruxure Foxboro DCS and all its tools come in."

On the CAPEX side where design and construction are the main goals, Schneider Electric's primary solutions

"We improve continuity of service by anticipating failures with process and device diagnostics, which reduces downtime." Schneider Electric's Alain Ginguene explains the future-proofed capabilities of the EcoStruxure Foxboro DCS.

come from the AVEVA software portfolio. However, as users and their projects move toward startup and operations, Schneider Electric's historian, process automation system (PAS), and planning and scheduling tools start to take the reins. The other part of this OPEX phase is maintenance, where users implement Schneider Electric's enterprise asset management (EAM) software.

"Because about 30% of work on projects is actually rework, we stress on both the CAPEX and OPEX sides identifying and doing only work that's useful," added Ginguene. "For instance, our vision for FLEX simplifies the steps in a project, but it also enables different participants to work in parallel, so they can finish more quickly and avoid a lot of former rework. This is possible because users can do cloud engineering and testing, intelligent enclosures, intelligent commissioning and digital hardware ordering all at the same time, which also means faster startups."

Likewise, iPMCC works with EcoStruxure Foxboro DCS to integrate electrical distribution, motor control and protection functions into intelligent and communicating architectures, according to Ginguene. "Integrating iPMCC and Foxboro DCS reduces CAPEX and improves project schedule control by using pre-engineered solutions, saves on integration costs, and shortens and secures the integration schedule," he said. "We improve continuity of service by anticipating failures with process and device diagnostics, which reduces downtime. We reduce OPEX costs with asset management aided with condition monitoring, and easy and fast device replacement. This also helps reduce energy, maintenance and technology evolution costs."

EcoStruxure Foxboro DCS and iPMCC also jointly enable process efficiency using a method similar to how the Internet of Things (IoT) operates, according to Ginguene. "We're also combining the cycle used to run physical assets with the cycle used for the digital-twin simulations into one loop, so they can serve as one global asset," he added. "This means users now get always-current updates about all the systems they need to run their plants."

Ginguene reported that Schneider Electric's vision for EcoStruxure Foxboro DCS is to have it deliver:

- Safe and secure operations by deploying a future-proof solution with reliable equipment and a continuously secure DCS;
- Early return on investment (ROI) at minimum cost and risk by using FLEX from design to running the plant;
- Value-focused Industrial IoT (IIoT) functions with help from plantwide integration of smart assets and analytics;
- Empowered workforces, which can use best-in-class HMIs with IIoT support for second-level support to improve plant performance, and safely run right up to capacity; and,
- Improved production value by employing patented, real-time accounting functions combined with Schneider Electric's Profit Advisor software.

"EcoStruxure Foxboro DCS is a future-proof DCS that consistently delivers measurable operation profitability improvements, and does it safely," said Ginguene. "Just like the IIoT, we're delivering the right information to the right people at the right time to make the best possible decisions."

REFINERY MARKS 'QUICK, CLEAN' CUTOVER TO FOXBORO DCS

By Paul Studebaker

In 2012, the 180,000 BPD Trainer refinery, located in Trainer, Pa., was sold by Phillips 66 to new startup company Monroe Energy LLC, a subsidiary of Delta airlines. Among the many challenges Monroe Energy faced was a well-past-its-prime Honeywell TDC 3000 DCS used by the Oil Movement and Storage (OM&S) department.

"The Schneider approach resulted in major time and money savings. We made a fast cutover and achieved smooth operation." Monroe Energy's Paul Maghan described the recent modernization of the refiner's OM&S system from an older Honeywell system to an EcoStruxure Foxboro DCS.

"I'm not an engineer," said Paul Maghan, special projects supervisor, Monroe Energy LLC, to attendees of his session at the 2018 Foxboro User Group conference this week in San Antonio. "I came out of school with a degree in computer science and couldn't find a job in my field, so I started at Phillips 66 as an operator. After four years, I was promoted to console operator, which is a supervisory role, then to area lead, where I was asked to assist on this project."

The refinery dates back to 1912 and was owned for many years by ConocoPhillips, a large corporation "where facilities had to fight for capital," Maghan said. For many reasons, "We almost never got any." Major failures would be repaired, but improvements were rarely made.

"Monroe is all about making huge improvements," Maghan said. "Leadership supports us. We've implemented multiple projects, and we're not afraid to try new things."

A decent proposal

The plant was controlled by four EcoStruxure Foxboro DCS on the process units, a Wonderware system on the wastewater treatment plant, and a Honeywell TDC 3000 in the oil movement and storage (OM&S) department, which handles all the plant's petroleum imports and exports. It includes two ship docks, a marine vapor control system, a gasoline blending header, two railcar docks, multiple pipelines and 93 storage vessels adding up to 4.5 MMbbl.

"Our Honeywell system was kind of a mess," Maghan said. The Honeywell support contract had been allowed to lapse, and due to the system's poorly documented programming, "We had to use engineers for console operations." Finally, faced with deteriorating system reliability, a request for proposal (RFP) was initiated in mid-2013 to upgrade the system.

"The RFP was comprehensive on a higher level, but it had no input from operations," Maghan said. "It had the process operations, control system architecture, control philosophy and alarms specified in detail, but it was written to simply replace the existing system."

Schneider Electric's RFP was chosen partly because it would be homogenous with existing systems, but also because it promised rapid cutover. "It required no bulldozing—it would use the existing architecture and cabinets," said Maghan. Schneider also warrantied a range of existing Honeywell components. "We have more than 1,200 I/O, and we kept the Honeywell backplanes, which are included in the new system warranty," he said.

The plant's lost profit opportunity (LPO) cost is $150,000 per day, and if OM&S couldn't operate, the available storage dictated a three-day window or the tanks would run over. "A similar project on another unit using a bulldozer approach took six weeks, and we wanted to avoid that," Maghan said.

Quick, clean cutover

The Honeywell system had been in service for 26 years, and ongoing changes had been poorly documented. It included out-of-service equipment—a complete ship dock, for example, with its safety systems. It had also been personalized over the years. "One of the employees had programmed what he called 'Dirtbag' alarms—Dirtbag 1, Dirtbag 2, etc.," Maghan said. "If a Dirtbag alarm came up, the operator had to call him and he would tell them what to do."

Due to such ad hoc modifications and poor documentation, "The factory acceptance test (FAT) extended way beyond expectations," said Maghan. "The hardware FAT

went well but documentation took more time. The automatic software conversion was fast, but led to a lot of configuration errors, so we went to 100% check-out.

"Part of the problem was that our department is too small and we had too many projects going on at once. And because if the importance of OM&S, we couldn't freeze the Honeywell console."

Cutover was done in two steps. "In step one, we set up a temporary Foxboro I/A station in parallel with the TDC 3000, defined the critical loops, and cut them over. This let us pretest the loops and gave us a path to reverse if needed—but we didn't have to do that," Maghan said. Concurrent operation let the operators see the Foxboro graphics while operating the existing system.

In step two, they planned and prioritized loop checks, doubled the operator coverage, cut over the remote I/O cards and did the loop checks. Again, they could reverse if needed, but it never came to that.

Lessons linger on

In retrospect, Maghan said they could and probably should have used a third party for documentation, to ease the load. Also, "We didn't realize that some of the new graphics would be very different—our systems have all the running pumps in green, stopped pumps are red. The standard in the power industry is the opposite, so it was confusing at first," he said.

Maghan also wished they had involved operations earlier in the process. "We should have frozen the design so we didn't confuse them with running changes, and we should have gone through the nomenclature with them before we cut over," he said. Later, "We needed to make changes to the graphics to give them what they're used to seeing," he added. "And we gave them touchscreens but they wanted trackballs, so we got them trackballs and now we have 10 touchscreens that nobody touches."

But in the end, "We made a fast cutover and achieved smooth operation," Maghan said. The initial bids had all looked similar, he added, but most would have required bulldozing of the old system—the costs for which were not included. "The Schneider approach resulted in major time and money savings."

OIL AND GAS DIGITIZES, SAVES WITH ECOSTRUXURE SOLUTIONS

By Jim Montague

Is it possible to stay sane in a chaotic situation? You might say "no" if you'd been through all the recent upheavals experienced by upstream, midstream and downstream oil & gas producers in the U.S. and worldwide. However, you might say "yes" if you'd weathered these storms with better use of today's simpler digitalized optimization tools, and had a helpful partner like Schneider Electric to help implement them.

"The U.S. oil and gas market is growing rapidly after some recent downturns, with the Permian Basin alone expected to produce more than every OPEC member except for Saudi Arabia," said David Gaertner, vice president of Schneider's global petrochemical business. "This means all kinds of new pipelines and other equipment is needed, and the future looks bright for the U.S. oil and gas, petrochemical and chemical markets."

To help these and similar ventures get up and running, Gaertner reported the $100-billion industrial automation market has returned to 4% annual growth, while the younger Industrial Internet of Things (IIoT) market is undergoing about 8% annual growth. Gaertner and Janet Parker, product manager for control system simulations at AVEVA, majority-owned by Schneider, presented "EcoStruxure Plant—Oil, Gas and Petrochemical

"It takes the available plant productivity data, deconstructs it into performance by individual applications and assets, and identifies where changes and improvements can be made." Schneider's David Gaertner explained how the company's Profit Advisor solution can make bottom line impacts to a plant's economic performance.

Solutions, Market Update & Digital Transformation" this week at the 2018 Foxboro User Group conference in San Antonio.

Profit Advisor deliverables

"Within EcoStruxure Plant, our Profit Advisor software performs historical data review and analysis, real-time performance indication, and profit planning," explained Gaertner. "It takes the available plant productivity data, deconstructs it into performance by individual applications and assets, and identifies where changes and improvements can be made. We also integrate high-level models, which include feedstocks, energy costs and the value of end products, which are primary indicators, too."

Gaertner reported that using Profit Advisor can generate 1-3% improvements in production value and 3-5% reductions in energy and material costs. These gains are typically made by:

- Enabling effective business diagnostics of profit constraints;
- Empowering workforces to learn how to drive operational profitability;
- Making return on investment (ROI) of improvements measurable and visible; and,
- Achieving repeatable and scalable time to value.

Training, simulation to the fore

Parker added that AVEVA recently helped a U.S.-based chemical company with global operations update the training program for its oxidation and distillation lines, and empower operators with dashboards developed and implemented on a EcoStruxure Foxboro DCS, which enabled its operators to achieve energy savings of $5.4 million per year.

"They used to have a regular training room, but now it's all multipurpose, dynamic simulations of EcoStruxure Foxboro DCS on the Microsoft Azure cloud service, which can be spun up for any number of users on their PCs or tablets," said Parker. "When we implemented these dynamic simulations for a greenfield olefins plant in Pennsylvania, we found that its instrument and pipe sizing might be wrong about three years before production is scheduled to begin, and now the user is investigating and may revise its design."

Likewise, the Total La Mède refinery in Châteauneuf-les-Martigues, France, was recently converted into a biorefinery and training center that can train 1,800 field and control room operators per year using a mix of hands-on and computer-based training. The project addressed three training requirements, including replacing its obsolete, generic training simulator; expanding training across the enterprise; and developing workforce competencies. As a result, Total also enlisted AVEVA to help in its digital transformation, and adopted its operator training simulator (OTS) solution in all its plants.

"We delivered several AVEVA modules to Total, and they're planning to train about 5,000 staffers in all," added Parker. "Schneider Electric bought AVEVA to enhance the whole value chain we can provide our customers, including comprehensive, closed-loop, digital asset lifecycle management and unified engineering."

DEFINING PROCESS AUTOMATION'S NEXT GENERATION SYSTEMS

By Jim Montague

If you're going to dive headfirst into the digital transformation of process automation, one of the rocks you may hit is a lack of interconnectivity and interoperability. That's why it's crucial to examine all swimming venues, and check out the efforts of the Open Group's Open Process Automation Forum.

Its approximately 80 members, including end users, system integrators and suppliers like ExxonMobil, Lockheed, Schneider Electric and others, are seeking to develop a truly open and interoperable process control system—and they could use your help, too.

"It's not uncommon for industrial users to say to industrial suppliers something like, 'We don't like what you're selling us, and we want better, but not just incrementally better—a whole lot better," said Dennis Brandl, chief consultant, BR&L Consulting Inc., and OPAF committee member.

Brandl updated attendees of the 2018 Foxboro User Group conference on OPAF activities this week in San Antonio.

Closed controls persist

Brandl reported that achieving this long-sought, much-desired, plug-and-play process control nirvana has been difficult for several important reasons.

"Current automation and operations architectures haven't changed significantly since the 1980s," reported Brandl. "They're still based on the concepts of one or more computers in a hardened box, which are connected to tens to thousands of I/O points and dumb devices, which are monolithic, vendor-specific, and closed. There have been incremental advances in functionality, and decreases in size and cost, but the basic architecture has remained the same. As a result, advances shaking up the world with connected smart devices in homes, stores, health care, transportation and energy haven't penetrated the barrier of obsolete industrial system architectures."

Brandl explained that many end users remain devoted to traditional, single-vendor controls because they boast

"OPAF has a vision this will lead to an open and dynamic market with the benefits of competition and innovation for all end users, vendors, integrators and maintainers." Consultant and OPAF member Dennis Brandl delivered an update on the Open Process Automation Forum's efforts to develop an open, interoperable process control and automation system at this week's Foxboro User Group conference in San Antonio.

better than 99.999% system availability. "They also have simple, deterministic system functionality, such as proprietary function blocks and custom programming," he said. "Physical coupling of a field I/O sub-network to one and only one controller creates a self-contained, closed regulatory control appliance. They also have one system designer and integrator, issue a standard product release that ensures compatibility, and provide a single point of contact for all system performance issues, so there's no opportunity to point fingers at other suppliers. Unfortunately, they have historically relied on 'security through obscurity' as well."

Redefine broke—then fix

Despite their traditional advantages, closed controls retain many characteristics that hold back users and constrain their growth.

"I/O on a closed network are normally, physically connected to only one controller, so any new application using that I/O must fit into the connected controller," said Brandl. "If the controller becomes loaded, however, I/O and associated applications may have to move to another controller. If the I/O network becomes loaded, adding I/O requires a new controller, even if the existing controller has spare capacity. So, you're limited to whatever control programming language and built-in capabilities are provided by the vendor. This means no best-of-breed solutions allowed or they're very expensive."

In this constrained environment, controllers can't be upgraded to exploit new, more sophisticated functions due to the cost and risk associated with replacement, according to Brandl. "Stagnant controller capability doesn't allow facilities to exploit the competitive advantage of new technologies," he added. "Migrating hierarchical systems usually require concurrent controllers and I/O replacement, which drives up project cost, complexity, duration and risk.

"The result is few replacements are done and systems are decades old," Brandl said.

Wish list produces open vision

To break free of these constraints, Brandl reported that process control users have developed a wish list of capabilities:

- Federated, modular, scalable and extendable system architecture that's conformant with existing field device standards and communication protocols; can assign any I/O to any networked device; and simple, online addition/replacement of any networked device as a maintenance activity.
- Distributed, portable, interoperable automation. This includes the ability to execute an application on all compliant platforms (portability); deployment of interactive applications on different platforms with no modification (interoperability); and standard exchange of both structure and unstructured data between adjacent system levels.
- Security by design, which includes embedded security layers that can evolve with emerging threats; verification of message authenticity and integrity with a simple key management system; authentication of new network devices; authentication of all new executable code; and automated intrusion detection and prevention.
- Productivity improvements, such plug-and-play field devices, intrinsic system notification tools such as alarms, alerts, advisories, etc., and reduced costs associated with patch management, software updates, etc.

"OPAF is seeking a federated, secure, open, interoperable, highly modular, vendor-independent manufacturing operations and automation control system that's upgradeable without production loss," said Brandl. "That's a big mountain to climb. However, OPAF has a vision this will lead to an open and dynamic market with the benefits of competition

"“Physical coupling of a field I/O sub-network to one and only one controller creates a self-contained, closed regulatory control appliance.”

and innovation for all end users, vendors, integrators and maintainers. This will also let participants improve their systems over time, like upgrading smart phones."

Reference model to O-PAS

By following their vision, Brandl reported that Exxon-Mobil, Lockheed and OPAF's committees and members have developed a new, open-market network and control architecture with three main parts:

- Distributed control nodes (DCN) with I/O that support real-time application processing and interfaces with other network protocols. Resulting systems will be collections of DCNs with or without I/O, or a DCN-cloud that provides execution environment of potentially hundreds of thousands of control nodes and intelligent devices.
- Standardized interfaces from high-end data-center host servers to redundant embedded computers hardened for harsh field environments to simple devices.
- High-speed, Internet protocol (IP)-based, wired or wireless Ethernet switch fabric that supports Layer 3 switching, VLANs, TSN, and QoS to allow the most network flexibility and segmentation. This network will also have interoperable protocols for distributed control, and execute multiple levels of control strategies, distributed to the DCNs.

"The Open Group and OPAF want to develop a marketplace of open, dynamic, interoperable components, where DCNs can talk to any I/O," added Brandl. "This is much better than trying to build a distributed control system (DCS) from scratch, which could cost billions of dollars."

Brandl added the complete structure of the Open Process Automation Technical Reference Model (TRM), Technical Architecture Reference S184, is freely downloadable at https://publications.opengroup.org/s184. It provides a snapshot of what's intended to become a finished Open Process Automation TRM: Technical Architecture.

"It's important to remember that the TRM lays out the architecture of interfaces, but not components or what's inside them," added Brandl. "This architecture model shows how interchangeable components implementing the interfaces can fit together into a system. Interfaces define how components expose functionality, and developers expose interfaces, but their content remains confidential and protected."

In addition, the O-PAS architecture and specification is driven by 10 quality attributes:

- Interoperability—ability of two or more systems or components to exchange information and use the information exchanged.
- Modularity—degree to which a system or computer program is composed of discrete components, so that a change to one component has minimal impact on others.
- Standard conformance—process of developing and certifying systems or components to meet 100% of the OPA specified technical standards.
- Scalability—degree to which a system can have its capacities adjusted to meet system requirements.
- Securability—ability of a system or component to protect against unauthorized access or modification throughout its lifecycle.
- Reliability—ability of a system or component to perform its required functions under stated conditions for a specified period of time.
- Affordability—characteristic of design, expressed as a solution that meets a customer's requirements at an acceptable price for recurring and non-recurring costs.
- Portability--ease with which a system or component can be transferred from one hardware or software environment to another.
- Availability—degree to which a system or component is operational and accessible when required for use.
- Discoverability—ability of a configuration item or its information to be found, and ability to find an item and understand its information exchanges and capabilities.

Once the TRM and its architecture are complete, Brandl reported, the plan is to create an eight-part OPAF-Process Automation Standard (O-PAS) specification and standard. Its parts will include its technical architecture, security aspects, profiles, OPAF communication framework (OCF), system management interface, application portability and physical platform. As a "standard of standards" it will borrow from established standards, such as:

- IEC 61131-3—PLC Open;
- IEC 61499—distributed function blocks;
- IEC 62541—OPC UA, as well as OPC UA companion specifications;
- IEC 62714—AutomationML;
- ZVEI-MTP—module type package;
- DMTF/Redfish from the IT side;
- IEC 62769—FDI;
- IEC 62682/ISA 18.2—alarm management; and
- ISA/IEC 62443—ISA 99 for security.

DISRUPTORS AND DRIVERS SHAPING VALUE OF DIGITALIZATION

By Mike Bacidore

Technology is not an end in itself. It's a means to value and profitability. It's become ubiquitous. But, most of all, technology is opportunity. "We have more technology available to us today than ever has been present for humanity in the past," said Andrew Kling, director, cybersecurity and system architecture, Schneider Electric.

He explained the opportunities and drivers that are pushing digitalization in his presentation at the Foxboro User Group Conference this week in San Antonio. "How we apply that technology will matter to all of us in the end," he said, identifying four disruptors that are having a big impact—the Open Process Automation Forum, NAMUR, Industry 4.0 and the accelerating speed of business.

The Open Process Automation Forum is a consensus-based group of end users, system integrators, suppliers, academia and standards organizations. "They're driving a secure, open, interoperable, vendor-independent control system that is upgradable without production loss," explained Kling. "We'll be able to upgrade plants on the fly in the future."

Meanwhile, NAMUR, a consortium of primarily European end-user organizations, is promoting the development of an inexpensive, vendor-independent data acquisition system that recognizes the need to potentially bypass the process control system.

The Industry 4.0 paradigm recognizes high levels of customization based on open systems, powered by dynamic business. And the speed of business continues to increase, with control decisions being made in real time. Thanks to innovations such as time-sensitive networking, connectivity and delivery can be guaranteed, despite other traffic on the network.

Digital enablers

Kling also identified what he sees as the five most important drivers of digitalization—connectivity, edge computing, the cloud, virtualization and analytics. "Connectivity is important to bring together smart devices," he said. "Edge computing is the result of pervasive and affordable connectivity, as well as high compute capacity. "IIoT is about solving a problem where it needs to be solved and then reporting back to the system," said Kling.

"The cloud is simply a massive aggregation of data," he explained. "Data can be accessed by specialists in an industrial-application-developer ecosystem. But the data

"In the industrial control system world, we have known about embedded computing for years. Now it's named IoT or IIoT, and advancements are changing the game." Schneider's Andrew Kling discussed the key technology enablers that are shaping the digital transformation of industry.

doesn't have to be elsewhere. There are all sorts of reasons we might want cloud technology on premises."

Virtualization enables the ability to have mobile solutions, and analytics are driving cognitive applications, in which artificial intelligence is optimizing performance at all levels.

Why is connectivity important? "There's this concept of a lighter footprint," explained Kling. "Network convergence, network virtualization, the Industrial Internet of Things (IIoT) and sensors are driving up connectivity and bandwidth needs. We're reaching a point where we can prioritize data. These concepts add up to a lighter physical footprint, but at the same time an increase in bandwidth, supporting the demands of future applications."

Why is edge computing important? "With more powerful processors, embedded sensing technologies, increased abilities to communicate, lower power consumption, smaller footprints and mobile applications, we can start to take an application that used to run on a server and run it where it makes the most sense," explained Kling. "In the ICS (industrial control system) world, we have known about embedded computing for years. Now it's named IoT or IIoT, and advancements are changing the game."

Why is cloud computing important? "You're able to ramp up very quickly on the CAPEX side," he said. "Business agility, low capital expenditure, less operational issues and better use of team resources add up to a lighter physical footprint, but at the same time an open-ended range of services and significantly reduced up-front costs. You require less equipment on-site."

Why is virtualized computing important? "We're talking applications you don't have to install any more," explained Kling. "It's already set up on a virtual machine. Network convergence, network virtualization, IoT and sensors mean a lighter physical footprint and an increase in bandwidth supporting demands of future applications. You can take advantage of these resources on-premise or off-premise."

Why are analytics important? "The world is catching up to analytics with computing power," said Kling, who recalled a time, after finishing his master's degree, when the promise of artificial intelligence was unfeasible because of limited computing power. "But analytics applied to data lakes—pools of large amounts of data—will enable solutions we haven't even imagined."

"Digitalization enables customers to effectively manage their key challenges, which include profit optimization; decreasing technology cycle time; the "great crew change" (to the next generation of workers); safety of people, assets and environment; cybersecurity; and breaking down information silos," said Kling. The digital architecture enables optimized engineering for lower cost schedules and lower risk in capital project engineering; efficient operations through monitoring and control to ensure safety and performance; reliable assets that can be tuned to behave as desired; and an empowered workforce.

MAINTENANCE TOOL EASES STRESS DURING PAPER MILL START-UP

By Paul Studebaker

Today, a maintenance technician typically goes out in the field and performs either breakdown maintenance, or time-based inspections and preventive maintenance. "Our research shows 63% of trips to the field are for routine inspections (35%) or find no problem (28%)," said Manoj Chandrasekharan, offer director, asset management, process automation, Schneider Electric. "Those are wasted effort."

When Klabin SA's greenfield Puma plant started up in March, 2016, it had more than 2,000 field devices with the wrong configuration, 600 loops in manual, 500 bypassed interlocks, an average control loop error of 35%, and more than 550,000 alarms per hour.

Instead, they can do predictive maintenance based on the condition of the asset. "They can monitor assets in real time, know before and act to prevent a failure," Chandrasekharan said. "Predictive maintenance can be done on any automation asset."

Chandrasekharan spoke to attendees of his session at Foxboro User Group 2018, this week in San Antonio. "Maintenance might have to deal with 500 to 800 assets per day. How can you know the status of all of them?" he asked. Those assets are made by multiple vendors, and use multiple communication protocols. "You need an application for each type, typically 10 to 12 different applications," he added. "The life of a maintenance guy is a tough one.

"Mobility and digitalization is a critical need, so the maintenance guy doesn't have to walk all the way back to his PC for information. We need to minimize manual rounds, and to be able to access information from anywhere."

A better way to manage field devices

Traditional field device management solutions are narrowly focused on configuration and advanced diagnostics. But optimizing lifecycle performance of field devices to meet business objectives requires a much more holistic approach that goes well beyond tradition. Schneider Electric EcoStruxure Maintenance Advisor is a comprehensive predictive maintenance platform that monitors the condition of plant-wide automation assets; provides real-time reporting of emerging asset problems with context, criticality and corrective action; and has built-in workflow functionality to communicate maintenance actions from anywhere.

Then, maintenance needs a command center. "The operator has a station, accounting has their system, but maintenance has islands of information in work order management, asset information and diagnostics systems," Chandrasekharan said. "They need their own system, with one source of the truth, a maintenance HMI with maintenance SCADA, to see information, raise work orders, and track them."

Maintenance Advisor is a single application for a wide range of assets that can monitor transmitters, valves, drives, motor starters and switchgear in real time, automatically, across vendors. It can allow fast decisions by presenting information in the right way. "It can communicate that decision via work orders and assignments to the people who will do the work, and it can do it from wherever you are, you don't have to go back to the office," Chandrasekharan said.

An important aspect of Maintenance Advisor is Condition Advisor, which uses embedded diagnostics or programmed algorithms to monitor asset condition in real time; see bad actors; determine the potential cause, severity and impact; and recommend a corrective action.

"Alerts are defined by NAMUR 107, they're very descriptive," Chandrasekharan said. Corrective actions can be based on device vendor information or plant procedures. "Work orders can be generated in the CMMS or it can do it on its own," he added. "Press 'send' and it goes to the maintenance planner and is assigned to a technician. When the technician updates its status, it goes back to Advisor.

"You don't have to wait for everyone to report in the morning meeting, you already know the status."

Tested in the field

One of the earliest adopters of Maintenance Advisor is Klabin SA, the largest paper producer, exporter and recycler

in Brazil. Headquartered in Sao Paulo, it implemented the system on its greenfield Puma unit in Paraná. The Puma plant includes 28 operator and 24 engineering workstations, 32 servers, 41 FCP 280 controllers, and more than 23,000 I/O points, of which 4,254 are HART and 2,936 are Profibus.

When the plant started up in March, 2016, it had more than 2,000 field devices with the wrong configuration, 600 loops in manual, 500 bypassed interlocks, an average control loop error of 35%, and more than 550,000 alarms per hour, with 13 operators.

"We implemented a three-pronged approach," said Edemilson Bueno de Camargo, process engineer, Klabin SA, who joined the session by videoconference from Brazil. Using an emergency server, they applied EcoStruxure System Advisor to manage alarms and the safety system configuration, and to analyze operator actions. They used Maintenance Advisor to monitor the condition of process instruments, support decisions and support KPIs. And they implemented Control Advisor to monitor, tune and report loop performance."

The maintenance crew analyzed the alarms and their causes every day. Custom reports were developed to help everyone involved understand the issues, and after a few months, the plant reached 12 alarms per hour per operator.

Since then, Maintenance Advisor has prevented unplanned shutdowns by quickly identifying potential problems and directing maintenance attention. In one example, an air supply regulator on a critical valve in the evaporation plant had been turned off during maintenance. If the valve was actuated before the problem was fixed, the plant would have shut down.

A second example identified a corroded electrical connection in a valve positioner before it failed completely, also preventing a shutdown.

"Our future plans are to update the Control Advisor and Maintenance Advisor software versions to get more capabilities," said Camargo. "We also plan to add 17 instrument suppliers, provide reports to the management consoles, and add non-DCS instruments to Maintenance Advisor."

NEW DCS RELEASE FACILITATES PROFITABILITY IMPROVEMENT

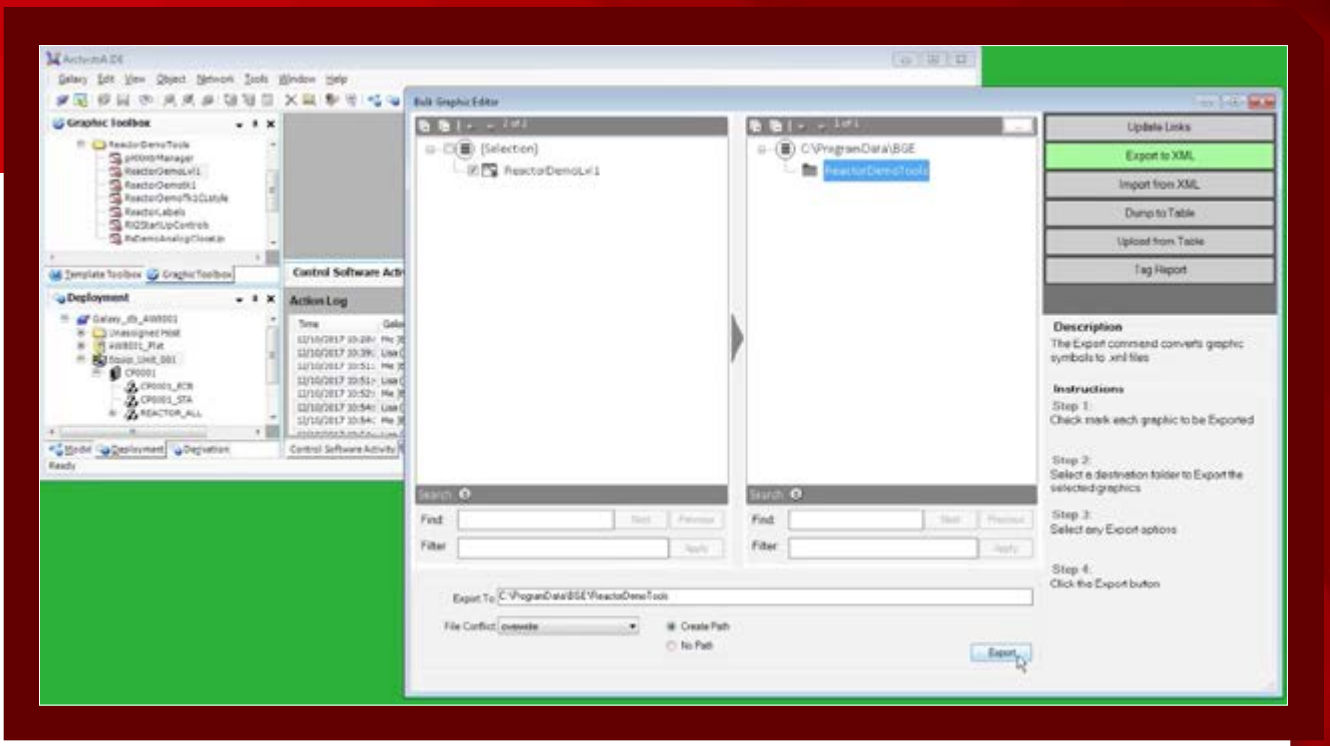
Byline

New 7.1 release of EcoStruxure Foxboro DCS Control Software is designed to help customers improve the real-time efficiency, cybersecurity, reliability and profitability of their assets and operations. With expanded capabilities and an enhanced HMI, the updated software simplifies engineering and enhances the user experience, while expanding the ability of EcoStruxure Foxboro DCS to drive measurable operational profitability improvements, safely. The new software version is on display at Schneider Electric's annual EcoStruxure Foxboro user group conference, this week in San Antonio, Texas.

The EcoStruxure Foxboro DCS process automation system is designed to provide highly accurate and effective control over a manufacturing plant's operational profitability, enabling a measurable 100% ROI in less than one year. With its high-capacity, high-availability control processors; powerful, fit-for-purpose I/O; intuitive, role-based engineering tools; and enhanced, intuitive operation capabilities; the continuously current Foxboro DCS is proven to:

- Improve time to first production by 30 percent.
- Reduce project costs and risk by 20 percent.
- Reduce maintenance costs by 30 percent.
- Reduce energy, material, engineering, operating and inventory costs.
- Empower the workforce to make better business and operational decisions in real time.

EcoStruxure is Schneider Electric's system architecture and platform, and was created to deliver enhanced value around safety, reliability, efficiency, sustainability and connectivity for the company's customers. EcoStruxure



leverages advancements in IoT, mobility, sensing, cloud, analytics and cybersecurity. This includes connected products, edge control capabilities as well as applications, analytics and services. EcoStruxure has been deployed in 480,000+ sites, with the support of 20,000+ system integrators and developers, connecting over 1.6 million assets under management through 40+ digital services.

Open process automation standard

"Schneider Electric understands and is driving the future of open process automation, and our EcoStruxure Plant platform will help us fulfill this vision," said Hany Fouda, vice president, Process Automation Offer Management and Global Sales, Schneider Electric. "The new control software migration path ensures our customers have continuously current technology. We have been the industry's standard bearer when it comes to open process automation since we launched the Foxboro I/A Series DCS more than 30 years ago. Our flagship DCS, the EcoStruxure Foxboro DCS, is built on this legacy. Updated EcoStruxure Foxboro Control software and other ongoing investments are enabling our customers to move from simply controlling their processes to controlling their real-time business performance. This approach provides for an easier, less costly transition into the future of industrial automation and a clear path toward success in the digital age. Our customers have never been better situated to succeed, now and tomorrow."

EcoStruxure Foxboro DCS Control Software 7.1 runs on Windows 10 and Windows Server 2016, to provide maximum flexibility while ensuring robust cybersecurity. When planning upgrades, Schneider Electric customers can mix Windows XP, Windows 7 and Windows 10 on the same system, allowing flexibility in scheduling and timing for upgrades. Customers can upgrade individual sections of the plant in any order, at any pace, to best accommodate plant production schedules. With Microsoft support for Windows 7 due to end in 2020, transitioning to Windows 10 allows EcoStruxure Foxboro DCS customers to benefit from the strongest operating system with the most up-to-date cybersecurity features.

Among other new and updated features, EcoStruxure Foxboro DCS Control Software 7.1 now includes:

- EcoStruxure Field Device Expert that improves efficiency, safety and profitability, while considerably reducing time for startup and restarts. It includes:
- Intelligent Commissioning Wizard, to reduce commissioning time up to 75 percent by automating HART device commissioning and documentation processes.
- Device Replacement Wizard to significantly reduce time and expertise to replace or commission HART devices, either individually or in bulk.
- Bundled HART DD library for increased security, faster device deployment, eradication of version mismatch and elimination of cybersecurity risks previously created by moving documents from the HART consortium web page into the system.
- New HMI Bulk Graphics Editor for increased operational efficiency and reliability by greatly reducing engineering hours and improving quality during testing.

Use in major projects shows that replicating hundreds of displays with the new Bulk Graphics Editor saves months of man hours and improves quality by delivering highly predictable results. The Bulk Graphics Editor makes migrating from the classic FoxView HMI to the new Foxboro DCS Control HMI easier, requiring far fewer engineering hours, which reduces the time and cost to transition between technologies.

- Control Editors Activity Monitor for increased efficiency by improving communication, workflow and collaboration.
- Real-time asset health condition monitoring for increased reliability.
- Future-proof technology supporting the latest FTD 2.0 standard, which improves compatibility with digitized field devices from Schneider Electric and third-party vendors.
- System platform update for version continuity with leading business software from AVEVA.
- New migration path,along with the new HMI Bulk Graphics Editor,simplifies the transition from existing FoxView HMI displays to the EcoStruxure Foxboro DCS Control Software 7.1 HMI platform for a continuously current and future-proof system. An upgrade migration path is available from previous Control Software Versions 5.x, 6.x and 7.0. After upgrading, users can tap into newer technologies that improve productivity, cybersecurity, efficiency and profitability.

"Our value-focused EcoStruxure Plant systems, solutions and services empower our customers to move from controlling only the efficiency of their assets and operations to controlling all their other business variables in real time, including their safety, cybersecurity, reliability and, especially, profitability," Fouda said. "Backed by our continuously current pledge, the EcoStruxure Foxboro DCS and EcoStruxure Foxboro DCS Control Software 7.1 ensure our customers are never left behind. These are just two examples of how we help customers convert their process automation investments into the profit engines of their business."

ECOSTRUXURE CONTROL ADVISOR BRINGS ORDER TO PID LOOPS

By Mike Bacidore

Closed-loop control in the process industries typically entails using a proportional-integral-derivative (PID) controller to regulate a modulating process, maintain a desired setpoint and compensate for load changes. A plant can have hundreds or even thousands of control loops, and many of them are often running poorly, whether from bad tuning or poor operation. With so many loops, it's almost impossible to analyze and maintain them all on a regular basis.

"We're all being asked to do more with less, be more secure and do it quickly," said Domenico Napoli, offer manager, Control Advisor, Schneider Electric, who explained the benefits of the loop-performance management software at this week's Foxboro User Group conference in San Antonio. "Control systems are becoming increasingly complex with a high degree of interactions. Control systems are constantly being modified. Identifying changes are difficult. There are many controls to look after and not enough time."

The process itself presents ever-changing control conditions, and the personnel with knowledge of the system are retiring in increasing numbers. And because there's so

"With hundreds or even thousands of control loops, it's hard to monitor them and keep them in control." Schneider Electric's Domenico Napoli explained how the company's Control Advisor can help users keep loops functioning properly.

much to monitor and maintain, plant personnel often let control systems function at an acceptable level or sometimes poorly, when optimizing that control would add to the bottom line.

"Control Advisor is a tool to speed up your existing work processes and make them more efficient," explained Napoli. "It's not supposed to be another task inserted into your busy day. What are your critical issues that you need to deal with? You don't need a Ph.D."

The cost of poor control

Loop performance is often under-monitored and under-maintained. Poorly functioning control loops can lead to off-spec product, increased equipment wear and tear, increased emissions and waste, plant-asset breakdown, increased waste, decreased profit and negative impacts on downstream processes.

Control Advisor is a browser-based analytics software that leverages real-time and historical data to monitor up to 2,000 plant loops. It provides performance reports, loop-tuning recommendations and plain-English actionable recommendations, allowing nonspecialists to improve loop performance.

"It can help you to increase efficiency and save time," said Napoli. Through energy savings up to 2% and increased productivity up to 10%, Control Advisor typically offers a payback in three to six months, he noted. Better performing loops also can improve quality and reduce maintenance costs.

"Ultimately the goal of the control loop is to follow your setpoint," explained Napoli. "A lot of control loops are in manual mode, which defeats the purpose of control. And a lot of the tuning being done is not optimal. These can affect the bottom line."

With the quantity of control loops in a large plant, the time needed to monitor and maintain them can be overwhelming, and shortcuts are often taken. "With hundreds or even thousands of control loops, it's hard to monitor them and keep them in control," said Napoli. "A problem we see is bad tuning and bad operation, which can lead to a variety of problems. Control Advisor is here to help. It will help you to find the root causes to bad behaviors in your control loops."

Loop performance analyzed

Once loop data is imported, Control Advisor shifts into analysis mode to see what problems it notices. "It also provides you with a level of confidence on the issues it shows you," explained Napoli. "It will see if you have loops that are oscillating or valves that are sticking. It can also help to find undersized and oversized valves."

Control Advisor is a server-based application and is designed to run on a Windows-based operating system, and it can run on VMware or a Hyper-V server. Licensing starts at 100 loops, and the first year of support is included. "We also have services that can go with the software package," said Napoli. "We offer 24/7 remote monitoring."

Schneider Electric also offers ongoing local and remote services to assess, monitor, prioritize, report and remediate suboptimal control-loop performance. In addition to the 24/7 monitoring, it includes full online diagnostic support for loops and valves, advanced loop analysis capability and on-site remedial action by Schneider Electric personnel.

Napoli shared two examples of companies that realized financial gains through their use of Control Advisor. The first found a poorly tuned loop that once corrected resulted in a 7% reduction in natural-gas demand—and an annual savings of $67,000. Another user was able to reduce thirteen tons per day of scrap wet pulp to only 2 tons/day. Product value and landfill expenses added more than $1 million to the bottom line.

TURN TO THE IIOT FOR SAFETY SYSTEM PROFITABILITY

By Keith Larson

Okay, so hooking one's safety instrumented system (SIS) directly to the public internet is clearly not a recommended best practice. But properly applied, many of the digital technologies that underlie the broader Industrial Internet of Things (IIoT) movement can streamline SIS engineering tasks, improve system performance and in the end contribute to higher plant profitability.

At this week's Foxboro User Group conference in San Antonio, Chris Stogner, Triconex offer manager, Schneider Electric, explained how technologies such as secure (and appropriate) connectivity, digital emulation and big data analytics are allowing safety systems to perform better as well as increasing the productivity and effectiveness of those engineers responsible for their design and support.

"The IIoT isn't necessarily about connecting to the internet," Stogner explained. "Rather it's about leveraging connectivity and other digital technologies to improve personnel productivity and system performance. And for an SIS, that performance is measured not only by safety, but also by the availability or uptime of the process in question. The SIS must respond when something goes wrong to prevent equipment damage, injury or loss of life. But the best SIS solutions also have the resilience to resist spurious trips that negatively impact production and profitability.

"Both safety and profit are critical to business success," Stogner said.

Safer plants make more money

Stogner cited a recent Center for Chemical Process Safety report indicating that companies with top notch safety performance practices also are 5% more profitable. "Their operations are not only safer, they're more reliable, they have less downtime and they even have lower insurance rates—all of which have a direct impact on profitability."

"These new technologies can make you safer and more secure," Stogner added. "Each new connection may add some risk, but the real question is: Does that connectivity add new value that outweighs the risk?"

Connectivity with the basic process control system (BPCS) in particular remains a controversial practice in some circles due to common-cause-failure concerns. So to address every organization's own risk-to-benefit calculations, Schneider offers three different three digital connectivity options: integrated (with its own EcoStruxure Foxboro DCS), interfaced or entirely separate.

The choice not to integrate with the BPCS, however, does not preclude the deployment of SIS diagnostics and preventive maintenance alerts that can be independently communicated to responsible personnel. Such alerts can

"Each new connection may add some risk, but the real question is: Does that connectivity add new value that outweighs the risk?" Schneider's Chris Stogner discussed the company's growing array of digital solutions that enhance the performance of its safety instrumented systems.

help to head off downtime before it happens. "Safety systems are moving beyond their traditional reactive role, to a more proactive role," Stogner said.

Maintenance Advisor is among those Schneider digital solutions that can help bird-dog process and system issues before they become upsets or shutdowns. The condition-based maintenance and decision-support tool monitors asset health in real time to provide early warning of impending failures—complete with recommended corrective actions.

More productive engineering and analysis

In the engineering realm, Schneider's latest generation of safety system, the Tricon CX, works with the company's Universal I/O and off-the-shelf Safety Intelligent Enclosures. This means that when ordering your next SIS you may only need know your total I/O count. "We can ship now, you can design later," Stogner said.

And with the company's unique, TÜV-certified Triconex Safety Validator solution, application safety logic can be tested in advance of physical deployment on an emulated version of the controller platform. Consistent with Schneider's FLEX (for flexible, lean execution) project methodology, this approach has delivered outsized returns for users. One company reported an 85% time savings—and earlier start-up by four days—in the course of a site-acceptance test. Another trimmed 216 man-days of labor from factory acceptance test (FAT) procedures.

Other Schneider digital solutions designed to ease SIS engineering tasks include Field Device Expert, which provides for rapid, intelligent digital commissioning of HART field instruments. Further, SIS versions of the company's System Advisor and System Auditor solutions provide enhanced configuration documentation, change tracking and I/O management for Triconex safety systems.

Post-incident investigation has also been significantly streamlined with the addition of Trip Analyzer functionality to the company's SIF Manager solution. Essentially big data analytics applied to safety system events, this solution dramatically reduces the time required to gather data and perform root-cause analysis on trips—a time-consuming tasks required by a significant and growing number of regulatory authorities.

CYBERSECURITY IS MORE THAN JUST A WORD; IT'S A MEASUREMENT

By Mike Bacidore

Founded in 2007, the mission of the ISA Security Compliance Institute (ISCI) is to provide the highest level of assurance possible for the cybersecurity of industrial automation control systems. It also functions as an operational group within the Automation Standards Compliance Institute (ASCI). "Founding members included Invensys Process Systems, now part of Schneider Electric; BP; Chevron; ExxonMobil Research and Engineering; Honeywell; Siemens; Yokogawa; Rockwell Automation; and ISA," explained Andre Ristaino, managing director of ASCI. He explained his organization's role and the benefits of ISASecure certification at Foxboro User Group conference this week in San Antonio.

ISCI's goals are realized through industry standards compliance programs, education, technical support and improvements in suppliers' development processes and users' lifecycle management practices. The ISASecure designation ensures that industrial automation control products conform to industry-consensus cybersecurity standards, providing confidence to users of ISASecure

"It's 360° product testing, including the product development process audit; functional security capabilities assessment; and device communication robustness and vulnerability test." ASCI's Andre Ristaino explained the benefits of ISASecure certification at this week's Foxboro User Group conference in San Antonio.

products and systems and creating product differentiation for suppliers conforming to the ISASecure specification.

Certification of conformance to IEC 62443

"ISASecure is the IEC 62443 conformance certification," explained Ristaino. "The International Society of Automation (ISA) has been around for more than 65 years. They've published more than 150 standards. In 2007, they set up the Automation Standards Compliance Institute, which I run. We operate as a consortium. The dues and fees we receive fund development and expansion."

The way the certification works is that asset owners specify ISASecure in procurement specifications and/or choose from the list of certified products on ISASecure website.

"Suppliers submit products to an ISASecure certification body of choice," explained Ristaino. "We use three existing labs—TÜV Rheinland in Cologne, Germany; exida, which was accredited in 2011; and CSSC, which was set up after the Fukushima incident in Japan. We write accreditation requirements for the labs, which must meet ISO/IEC 17065 conformance scheme and ISO/IEC 17025 lab operations by international ISO/IEC 17011 accreditation bodies."

Why certify commercial, off-the-shelf (COTS) products? "Security capabilities are independently assessed and certified by experts at accredited ISASecure labs," explained Ristaino. "It reduces the effort end users must make to validate and verify security capabilities. And it provides an objective metric for security capabilities based on industry standards."

ISASecure is one specification, one service mark and one assessment. "The standards are well-articulated," said Ristaino.

End user benefits include:

- Simplified procurement specification process,
- Easier-to-understand, standards-based cybersecurity capabilities;
- Capabilities independently validated by third party;
- Confidence that security features will evolve over time; and,
- A forum in which end users can ensure that ISA/IEC 62443 standards are implemented as intended.
- Supplier benefits include:
- Differentiation of solutions;
- Assurance to customers that products meet standards-based cybersecurity requirements;
- Assurance to customers that security is maintained over the product lifecycle;
- Cybersecurity as a dimension of product quality; and
- Third-party verification in the face of product liability accountability.

"You can't talk about security if you don't look at it in the concept of the control system lifecycle," explained Ristaino. "Cybersecurity is a shared responsibility."

Certification variations

Based on the 13 documents in the IEC 62443 standard family, three ISASecure certifications are available. Embedded Device Security Assurance (EDSA) is a vulnerability identification test. System Security Assurance (SSA) is for product certification. And Security Development Lifecycle Assurance (SDLA) is process certification.

"Our certification is more than just testing," said Ristaino. "It's 360° product testing, including the product development process audit; functional security capabilities

assessment; and device communication robustness and vulnerability test."

EDSA is a certification that the supplier's product is robust against network attacks and is free from known security vulnerabilities. It meets the requirements of IEC 62443-4-1 and IEC 62433-4-2.

SSA certifies the supplier's product, such as an off-the-shelf industrial control system, is robust against network attacks.

SDLA is for product development sites that have work processes and includes security considerations throughout the lifecycle. "It's based on industry-recognized security development lifecycle processes," explained Ristaino. "We used Microsoft's SDL as a basis for our SDLA. We had to modify it for OT (operational technology) situations because it was created primarily for IT environments. We donated that to the standards committee, and it was probably the fastest one to come out of the committee process."

Four different security levels exist for ISASecure product certifications.

"We have a tool recognition process, too," added Ristaino. "ISASecure test tool specifications and recognition process ensure that all test tools meet ISASecure requirements and provide consistent test outcomes. As each test lab uses a test tool, the outcome will be consistent. We're the only program that does that."

Looking forward, ASCI has plans to collaborate with building-control-system (BCS) stakeholders to ensure IEC 62443 and ISASecure certifications properly address BCS. It has also collaborated with the European Union on a conformity assessment program and is reaching out to other stakeholders including UL and industry groups such as ASHRAE, LOGIIC, CABA and NAMUR.

"Certification growth started slowly, but now it's taking off," explained Ristaino.

ECOSTRUXURE PROFIT ADVISOR SHINES LIGHT ON BOTTOM LINE

By Mike Bacidore

No business can afford to operate at a loss. It's just not sustainable. Rather, one of the central goals of business is to generate profit—ideally to maximize it moment by moment and over long-term time horizons as well.

But too often in process manufacturing facilities, it's really hard to tell the immediate bottom-line consequences of one's actions. Financials typically are reported on a monthly basis, and operators are used to controlling temperatures, pressures and feed rates—not the real-time flow of dollars and cents. If only there were a system designed to optimize operational profitability in real time, especially in these times of swift change and disruption.

Enter Schneider Electric's EcoStruxure Profit Advisor. Based on Industrial Internet of Things (IIoT) technology, Profit Advisor was created to empower the workforce to drive operational profitability improvements in real time.

Speed of business accelerating

"Disruptive forces of change are everywhere. The speed of business, any business, continues to increase. And technology changes are driving innovations," explained Tim Shope, director, pre-sales support & consulting, process automation, Schneider Electric, who explained what EcoStruxure Profit Advisor can do for users at the Foxboro User Group Conference this week in San Antonio.

"Industrial, utility and infrastructure operations are changing dramatically," said Shope. "Profit Advisor is automation that unlocks new business models and significant potential for our end-user and system-integrator customers in four key areas: operations, safety, asset/equipment reliability and profitability. Historically, we as an industry have done a terrible job of proving what financial impact the automation is having."

"You're going to get 1-3% of production value improvements and 3-5% of energy and material cost reductions annually." Schneider Electric's Tim Shope explained how an investment in Profit Advisor often pays for itself in as little as three or four months.

Profit Advisor is powered by Schneider Electric, built on the EcoStruxure platform and predicated on effective real-time process, reliability and safety control. "Most importantly, it extends process control to real-time profitability control," said Shope. "EcoStruxure Plant is a stack of devices. You've got Control Advisor taking care of your connected devices for PID loop monitoring. Maintenance Advisor is for monitoring the health of your equipment. And Profit Advisor is on top, helping operators to make profitable decisions in real time."

Profit Advisor calculates real-time accounting factors from standard process-historian data. The software determines how each action and each asset affect real-time operational profitability—and helps identify potential improvements.

"You're going to get 1-3% of production value improvements and 3-5% of energy and material cost reductions annually," explained Shope. "We turn customers' industrial automation investment into the profit engine of the business. You're talking three or four months for payback at this kind of rate."

Enabled by data analytics

In part through Schneider Electric's partnership with Seeq, a data analytics provider, Profit Advisor calculates the real-time financial performance of industrial operations from the equipment/asset level of a plant up to the process unit, plant area, plant site and enterprise levels. Whether on-premise or cloud-enabled, it works with almost any process historian to mine both historical and real-time data. It then processes that data through Schneider Electric's proprietary, segment-specific accounting algorithms to determine real-time operational profitability and potential savings.

"Profit Advisor is built on big-data analytics with the Seeq engine," said Shope. "It works with all major process historians and provides multiple analytical and visualization options, plus the basis for measured business value improvement."

EcoStruxure Profit Advisor empowers the workforce to help to make better business decisions with easy-to-understand tools that drive operational profitability improvements, safely and sustainably, Schope said. It does this by measuring and controlling real-time profit performance of every plant asset and asset set, applying big-data analytics and patented real-time accounting models to identify potential profitability improvements. Ultimately, it converts control and automation systems into industrial profit engines.

"Disruptive forces of change are everywhere. The speed of business, any business, continues to increase. And technology changes are driving innovations."

ECOSTRUXURE DIGITAL SERVICES ENABLE AGILE DECISION-MAKING

By Jim Montague

Even as Schneider Electric looks to close the loop on an increasing number of domains on behalf of its customers—from efficiency to profitability and beyond—it's also delivering a broad array of advisory digital services designed to help them make timely, informed decisions that advance the performance of their processes and businesses.

"As IT and OT converge, everyone wants to maintain safety, profitability and availability," said Farshad Hendi, safety services practice leader at Schneider Electric. "EcoStruxure can address these concerns from both perspectives, and help departments that used to be in separate closets to collaborate more closely."

"When data is collected, it can be routed to simple or sophisticated analytical functions," Hendi explained. EcoStruxure can then deliver descriptive data about the situation to the appropriate person who needs to act, including what happened, diagnostics about why it happened, predictive data about what will happen next, and prescriptions for what action to take. "EcoStruxure also delivers simple visual clues, so users can more quickly see and understand the complete picture about what's going on with their applications," Hendi said.

Hendi and Tom Kinney, digital services director, Schneider Electric, presented "Roadmap for Digital Services" this week at the 2018 Foxboro User Group conference this week in San Antonio.

Common-ground cooperation

Kinney added that collaboration among the different layers of process industry organizations is possible because even though they have different initial concerns, they also share some basic goals about essential tasks such as safety.

"Management wants to know if operations are running safely and if the company's actions are defensible," he said. "Operators ask if they're meeting production targets within safety limits. Engineers question if there are enough risk reduction factors in place. What they're all asking is: do we have the right information to enable us to make timely decisions that improve the control of major hazard risks?" Kinney said. "This is the question our EcoStruxure Safety Advisor software can help these groups collaborate around and answer together."

Beyond bringing different players together, Kinney added that it's also crucial for digitalized data delivery, analysis functions and displays to adapt to the unique needs of individual organizations and users. "As we move to maturity,

"What they're all asking is: do we have the right information to enable us to make timely decisions that improve the control of major hazard risks?" Schneider Electric's Tom Kinney discussed how EcoStruxure digital services can deliver role-based intelligence to a range of plant personnel, in this case stakeholders concerned about safety.

digital services must be flexible and allow multiple, different deployments and service-level scenarios," Kinney said. "As a result, we offer managed services through our Service Bureau [of live subject matter experts], unmanaged software as a service (SaaS) for application-focused online services, and data as a service (DaaS) for easier cloud and data sharing."

This allows Schneider Electric and EcoStruxure to help users connect all their assets from the shop floor to the top floor; collect and capture critical data at every level, including off-premise from sensors to the cloud; convert data into meaningful analytics; and drive action using real-time information and business logic.

Selection of services

Kinney reported that Schneider Electric's core goal for its EcoStruxure digital services offering is to provide insights of value to its customers.

"We're all prisoners of our past sometimes, but I learned over time to take a step back, and think more creatively about what we can do with tools like EcoStruxure," explained Kinney. "For example, one user developed a self-service tool for temperature and calibration that produces little certificates that can be printed locally. Other users took advantage of the tool, and now they're printing millions per year. It's important to embrace capabilities we might not have thought about in the beginning."

Some of EcoStruxure's primary digital service offerings include:

- **EcoStruxure Safety Advisor** is a cloud-based analytics and reporting software that identifies safety risks in process automation for critical process safety control applications, and provides alerts, reports and actionable insights. After data gathering and analysis, it delivers post trip/process safety near-miss analysis; dynamic risk visualization that pinpoints key changes to the safety system that could impact operations; advanced warning and operational risk assessment that enables better decision making based on actionable insights.
- **EcoStruxure Maintenance Advisor** is an on-premise condition advisor for monitoring asset health automatically in real time and on the cloud. It also uses Schneider Electric's Service Bureau to generate actionable alerts with full context, and by leveraging cloud-based tools to quickly realize full situational context. It delivers improved throughput and availability by ensuring critical maintenance items are flagged in a timely fashion; reduces maintenance efforts with augmented remote analyses; reduces health, safety and environmental risk; and improves organizational effectiveness.
- **EcoStruxure Operations Advisor** allows process and automation professional to quickly analyze operational issues, trace root causes and assemble recommendations. It consists of enhanced process alarm management, support for alarm audits and diagnostics, as well as process performance and value monitoring. It also has a field technician support tool with procedure guidance. It delivers easier data interpretation, enhanced collaboration, advice and guidance in complex situations, more time for operators to better manage production, increased reactivity and effectiveness, alignment on common goals and visualization, and deploys skilled personnel only as needed.
- **EcoStruxure Pumping Performance Advisor (EPPA)** provides asset performance management of pumping stations. Schneider's manned Service Bureau turns cloud data collected from pumping stations into actionable insights for customers. Users also have visibility into EPPA data through a web portal. It also helps users tackle operating expenditures, such as energy, maintenance and operations, and achieve an optimized balance between performance, risks and costs.
- **EcoStruxure Augmented Operations Advisor** shows context-sensitive real-time data and virtual objects projected on a live view of the plant environment. This can speed up maintenance by letting users find information faster with immediate, relevant access in the field, such as user manuals, instructions, diagrams, etc., and avoid unnecessary machine downtime with the ability to virtually "open" equipment like electrical cabinet doors. It can also reduce operator errors during maintenance by locating the right equipment and guiding operators step-by-step to complete procedures.

"Over the years, we've learned that the Industrial Internet of Things (IIoT), virtualization, cloud services and other kinds of digitalization must adapt to the requirements of individual companies, applications and users. And to do that they have to be flexible first," said Kinney.

"Second, having all the best software and graphics is meaningless unless they're provided in a context that's understandable. So, we also need to deliver people with expertise, P&IDS, log books and other resources that put the software, graphics and their analysis in the right context that gives value to its users. Third is cybersecurity, and it's embedded in all our offerings."

THE ENTIRE WORLD COMMITS TO THE INDUSTRIAL IOT

By Mike Bacidore

The Industrial Internet of Things (IIoT), like winter, is coming. "If you listen to the media, the world is changing, and IIoT will change everything," said Dennis Brandl, chief consultant and founder of BR&L Consulting, who spoke this week about IIoT innovation and trends in industry at the 2018 Foxboro User Group conference this week in San Antonio.

"Changes are gathering momentum in our industries," he explained. He cited the lily-pad example of exponential growth. If a single lily pad doubles in size each day and takes 50 days to cover the surface of a pond, the pond is only half-covered on the 49th day. "We are in the 49th day of IIoT," he said, noting a variety of telltale signs, such as the unprecedented processing power and functionality of smart phones. Not long ago 1 MB of memory cost a million dollars, while today it costs less than $100 for 10,000 MB. "We can do more today than we've ever been able to do."

Brandl also remembered when he started his career in controls and having to beg management for 32K of memory. How times have changed. "Now, 'smart' is cheap. 'Networked' is cheap. And memory is cheap," he noted. "Power requirements and size are rapidly decreasing. Markets will change. Companies will die, and new ones will rise. We will all change jobs."

Finally, the promise of the IIoT is being delivered. "We know this is real because people are starting to see benefits," said Brandl. "Countries believe in IIoT. Industry consortiums are on board as well."

The Digital Manufacturing & Design Innovation Institute in the United States, La France en 2025, Made in China 2015, the European Commission's Horizon 2020, the Future of Manufacturing & Remanufacturing in Singapore and Industrie 4.0 in Germany are just a few examples of countries' initiatives. The Industrial Internet Consortium, Smart Manufacturing Leadership Coalition, European Factories of the Future Research Association, OPC Foundation and VDMA are some of the industry consortiums that are committed to IIoT advancement. And new standards are being developed, including IEC SC65E Smart Manufacturing Information Models, AutomationML IEC 62714 and updates of numerous ISA standards.

However, despite the dedication of countries, consortiums and standards bodies to IIoT, many end users are still confused. "Isn't this just the latest information-technology thingy and buzzword?" they ask.

"We don't even know what our capabilities are yet," explained Brandl. "We're at the crawling stage. We're very bad at predicting the future and what we find essential once it is available. How did we live without Google Maps and Waze? Who knew we needed a camera on our phones? We don't know what we don't know."

"How did we live without Google Maps and Waze? Who knew we needed a camera on our phones? We don't know what we don't know." Consultant and industry veteran Dennis Brandl on the inevitability of the Industrial Internet of Things.

Like the lily-pad pond, our expectations will grow exponentially. "We will see an explosion in what our expectations are," predicted Brandl. "We expect we'll make better decisions, and the system will become our digital assistant all of the time."

Brandl has been working in standards efforts for quite a few years, and he is part of the group that is looking at all of these international models depicting the growth of IIoT and understanding how they will integrate.

"There are lots of dimensions, views and aspects," he explained. "It's very difficult to visualize the relationships. We've got a complex task to make sense of all of the work being done. There are dozens of models, hundreds of experts, continual physical and Web meetings, multiple viewpoints and multiple time scales."

The transition will be complex. Changing out systems and components becomes a challenge when they are integral parts of the equipment responsible for profitability. "How do I change the equipment when it's pervasive?" asked Brandl. "If you want to change that system, you have to shut everything down, so no one wants to change the system."

In addition to product and system lifecycles, the lifecycle of employees must also be considered. How do you keep someone trained in a job that won't exist in two years? And how do you prepare that employee for the future and the job that will exist when the current one is obsolete?

The questions are still many, and answers are still being developed. But one thing is certain. "IIoT is coming. Smart manufacturing is coming. Everything is going to be smart. It could be chaos, or it could be great," said Brandl. "End users, vendors and integrators are all working together, developing best practices for how to configure, manage, maintain and effectively use hundreds of thousands of smart devices in a smart manufacturing facility. It's not just Schneider Electric. Everyone out there in the world is looking at this."

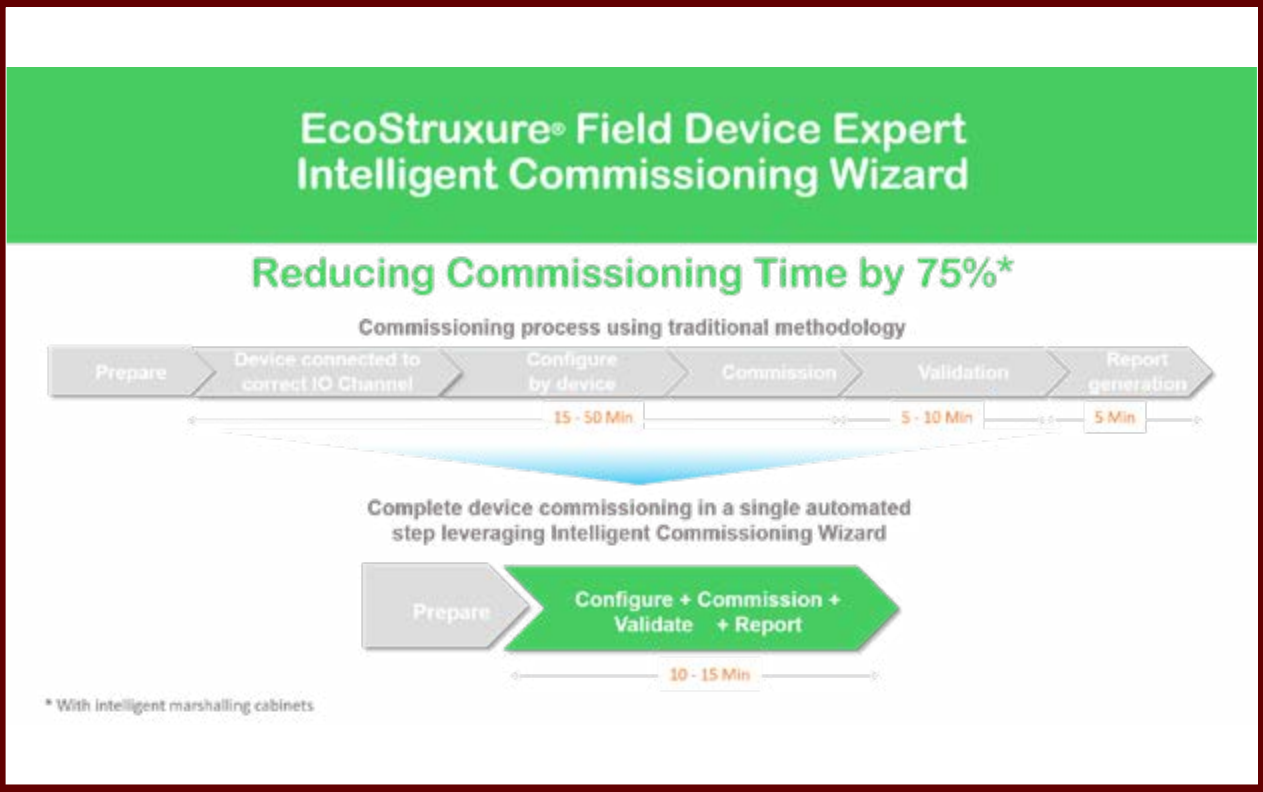
ECOSTRUXURE FIELD DEVICE EXPERT SPEEDS COMMISSIONING TIME

Byline

Commissioning field devices has traditionally been a headache that begins before startup and stays around for the life of a plant. And with today's shortage of skilled labor, the pain is getting worse. "You need two people to commission a device, one in the field and one in the control room. It's a manual effort that typically takes an hour per device," said Alain Ginguene, offer management director for the EcoStruxure Foxboro DCS, to members of the press at Foxboro User Group 2018, August 8 in San Antonio. Later, if a device must be replaced, more time is lost to configuration, and confusion often reigns about which version must be used.

"We reduce that time to 15 minutes, with a single button click," Ginguene said, introducing EcoStruxure Field Device Expert, an application that improves how engineers commission, configure and maintain field devices. Field Device Expert's Intelligent Commissioning Wizard completely automates detection, configuration, commissioning and testing of HART field instrumentation connected to an EcoStruxure Foxboro DCS. Automatic binding and configuration of HART devices has been shown to reduce commissioning schedules by more than 75 percent, leading to faster time to profit.

"A report by EY reveals that almost two thirds of multi-billion-dollar megaprojects continue to exceed budgets,



with 73% missing project schedule deadlines," said Hany Fouda, vice president, process automation offer management and global sales, Schneider Electric. "By automating the commissioning process, Field Device Expert significantly improves time to production and reduces effort, which has an immediate impact on project profitability. In one example, the return on investment calculations showed a savings of 96 days, which was the equivalent of $24 million of additional production for that project."

Traditional, manual device commissioning is manpower-intensive, making it error-prone, time-consuming and expertise-dependent. By automating the configuration and commissioning process, Field Device Expert significantly changes automation project execution by minimizing hardware dependencies and custom engineering, and offers more flexibility in the design, timing and sequence of activities. For example, with traditional commissioning methods, it can take up to 50 minutes to configure each asset. Field Device Expert's Intelligent Commissioning Wizard shortens that time to 15 minutes, which is a 70% reduction. Once the plant is operating, Field Device Expert continues to ease field device configuration and condition monitoring throughout the plant lifecycle which means restarts like those that occur after a maintenance turnaround or any shutdown are also faster and easier.

As part of Schneider Electric's EcoStruxure architecture and platform, Field Device Expert improves efficiency, safety, productivity and profitability. EcoStruxure is Schneider Electric's open, interoperable, IoT-enabled system architecture and platform and delivers enhanced value around safety, reliability, efficiency, sustainability and connectivity.

Now fully integrated into the Foxboro DCS, Field Device Expert's new capabilities include:

- **Data available in Field Device Expert** can be used by EcoStruxure Maintenance Advisor, a predictive maintenance and decision-support platform that reduces configuration time and human error.
- **Intelligent Commissioning Wizard** enables faster time to production and reduced commissioning effort and time. Engineers can commission devices 24/7 with no additional overtime cost.
- **Device Replacement Wizard** reduces time and expertise by automating HART device replacement, either individually or in bulk. Even when a device is replaced with a non-alike device, the software automatically executes the replacement, significantly reducing downtime in such cases.
- **Single Information Repository** increases safety and security by eliminating costly errors. The valuable information created during each phase of device management is saved in a single database so it can be used

throughout the lifetime of the devices.This unified database eliminates duplication and mismatch issues commonly experienced with independent DCS and asset databases. This also saves additional effort by providing a single, unified backup.

- **Access Permissions** for safety-related devices align with IEC61511-1, the prevailing industry standard that establishes best practices in the engineering of systems to ensure the safety of an industrial process using instrumentation.
- **Bundled HART device description library** enables faster device deployment, eradicates version mismatch, and eliminates cybersecurity risks previously created by moving documents from the HART consortium web page into the system. It also prevents users from browsing and downloading files from the Internet since engineers no longer need to search for them.
- **FDT 2.0 compliant frame** leverages the latest technologies (.NET over ActiveX/COM) and supports digital signatures to prevent tampering.
- **Interoperability** with any device, from any vendor, with any protocol. With Foxboro DCS interoperability and any-bus capabilities, users can maintain preferences because the system adapts to user choice.
- **Advanced Diagnostic Support** for vendor-embedded device type managers (DTM) enables maintenance technical personnel to access advanced diagnostics written specifically for the device by its vendor. Field Device Tool (FDT) device type manager enables flexible user interface, rich graphics and comprehensive diagnostics for field devices, even complex devices such as positioners.

"We are committed to helping our customers reap additional value from their assets and process automation investments," said Fouda. "Our goal is to help customers progress to a safe, secure digital operation in which they can gain control of all their critical business variables—safety, security, efficiency, reliability and, most importantly, profitability. Field Device Expert and Intelligent Commissioning Wizard are perfect examples of how we continue to help our customers convert their process automation systems and solutions into the profit engines of their businesses."