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Intelligent Maintenance – a level above uptime

Manufacturing and process industries today face many challenges, including market competitiveness, keeping process productivity high and managing costs. At Metso, we work with our customers to raise productivity and control costs by offering a comprehensive set of solutions targeted at these goals. We have transformed our organization to become your partner in improving productivity, maintenance efficiency and profitability. In short, our services add value. For us, the key is intelligence – in our people, our products and in our tools – so those skills are as close to customers as possible. Our solutions to improve our customers’ business operations and profitability are built on tried and tested services that have already delivered results globally.

We recognize that increasing our customers’ process efficiency has a direct impact on their profitability. Our performance solutions are targeted at maximizing production efficiency through a combination of diagnostic tools, products and engineering services. Our Control Performance Solution looks at ensuring that basic controls are working properly, your process is at top efficiency and the costs of energy, chemicals and raw materials are as low as possible. Our solution is built on our award-winning Metso ExperTune PlantTriage tool that we added with the acquisition of ExperTune in 2012. In addition, we provide a higher level of process performance with our process optimization services that ensure high quality and productivity at the lowest possible costs. This is accomplished by our process experts applying their knowledge through Advanced Process Control (APC) tools. Metso is the number one implementer of APCs in the pulp, paper and power industries and can point out many excellent results achieved by our team of experts over twenty-five years.

Intelligent Maintenance is the central concept that guides our people in providing our customers with that vital value-added factor that goes beyond just maintaining uptime. The Intelligent Maintenance concept is about focusing attention on the areas where it is actually needed. It’s about measuring, analyzing and understanding the condition of wearing parts and systems, and basing maintenance on performance and scheduling maintenance only when needed. The advantage of this proactive maintenance plan is that it normally lowers maintenance costs. As an added benefit, we can detect and correct unexpected problems that could cause a process outage if left unchecked. Our Customer Care package embodies these intelligent tools and working principles. Remote diagnostic services from our experts in any place in the world support our local people in diagnosing issues and thereby ensuring that process uptime is maintained, process performance is maximized and our customers lose less production when issues occur.

With the imminent cessation of support from Windows XP by Microsoft, it is also worth mentioning that we help our customer with investment and upgrade roadmap planning, since automation infrastructure needs to be updated occasionally to remain state-of-the-art. Our Metso Life program makes a life-cycle plan affordable through regular monthly payments toward a planned upgrade schedule.

Finally, we recognize that being close to our customers is vital for service excellence. We have a global network of 35 ISO 9001 certified service centers, also certified according to many local safety standards, such as ATEX.

In this issue of Results Automation, we hope you enjoy reading about the results of our solution portfolio as applied in the pulp, paper and power industry. We remain, at your service and hope to improve your competitive position over the coming years.

Mikko Keto
President
Services business line
In this issue we focus on solutions targeting success of our global pulp and paper customers

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Metso’s Automation business stands at the forefront in answering the global process industry challenges. Automation’s solutions are designed to maximize the profitability of our customers’ businesses by improving their production performance and their cost, material and energy efficiency. Our extensive range of flow control and process automation solutions and services is supported by a worldwide network of automation experts. The Automation business’ biggest customer industries are oil & gas, and pulp and paper. We also have a strong growth focus in mining and construction and power generation.

Metso is a leading process performance provider, with customers in the mining, construction, and oil & gas industries. Our focus is on the continuous development of intelligent solutions that improve sustainability and profitability. Metso’s shares are listed on the NASDAQ OMX Helsinki Ltd. Metso employs around 16,000 professionals in 50 countries. Expect results.
Improving pulp and paper mill processes in India

High-tech automation solutions make pulp and paper processes more efficient and sustainable. Automation expertise is available also for demanding relocation projects.

As the focus of the paper industry today is shifting towards more eco-friendly products and technology, several Indian paper mills and larger fiber lines have chosen Metso's automation solutions for their processes. Both large paper groups and smaller mills have understood the benefits of the scalable Metso DNA automation platform. In addition to the control system, Metso's total concept for the pulp and paper industry consists of advanced process controls, information management, condition and runnability monitoring, analyzers and valves.

“We have significantly strengthened our offering in India and created good contacts with the clientele. Our offering now well meets customers' demands and their need to improve process efficiency. Eco-friendliness is also an important topic,” says Pravin Tripathi, National Sales Manager, Automation, Metso.

Optimized operating costs, improved product quality
Khanna Paper Mills Ltd., one of the largest recycled based paper mills in India, has relied on Metso's technology for a long time. The company produces 3.3 million tons of paper per year and is among the top ten paper producers in India. With a distribution network of more than 100 dealers, the company serves the domestic market along with exporting products to the South Asian Association for Regional Cooperation (SAARC) countries, Africa and the Middle East.

Recently, Khanna invested in Metso's CORMEC Brightness and ERIC inline sensors at its 320 tpd DIP plant. The reported tangible results and savings include reduced Na$_2$S$_2$O$_4$ consumption of up to 15%, reduced H$_2$O$_2$ consumption of up to 10%, and reduced brightness variability of more than 20%.

“Controlling DIP with the lab results was really a herculean task, and we are happy we made the right decision. We are now implementing the same strategy on our next DIP line in partnership with Metso,” said S.K. Tiwari, Deputy General Manager of DIP.

Towards more uniform product quality and minimized machine downtime
Another Indian company that has repeatedly chosen Metso's technology for its processes is Naini Group of Industries in Kashipur, Uttarakhand. In 2011, Metso supplied a Metso IQ Quality Control System with a Metso Slice Profiler to the mill. Based on good experience with the equipment and support given by Metso, the mill has now placed an order for Metso IQ Quality Control Systems and Metso Steam Profilers for its PM 1 and PM 2.

With the investment, the mill is especially targeting uniform product quality and minimized machine downtime.

Naini Group produces about 250 tpd of environmentally friendly, quality writing & printing grades with a high level of physical and optical properties from agricultural residues, such as bagasse and wheat straw, along with imported wood pulp. The group is producing both non-surface-sized as well as surface-sized papers.

“Our approach of providing a solution rather than a product gives us a clear edge over the competition,” says Rakesh Uniyal, Regional Sales Manager, Automation, Metso.

Relocation calls for accurate automation
To start pulp or paper production cost effectively, relocating a production line can be a good alternative. Relocation projects in which existing automation systems are replaced with the latest technology solutions demand profound expertise and experience, and Metso has plenty of it.

One of the customers to carry out such a relocation project with Metso is BILT Graphic Paper Products Limited, a subsidiary of Ballarpur Industries Limited (BILT). After Metsä Fibre’s Kaskinen pulp mill in Finland was closed, the production line was restarted at Ballarshah, India, as a part of a mill modernization plan.

Extensive pre-surveys by Metso's professionals preceded the installation of a Metso DNA automation system to control the entire pulp mill. Brightness, residual and cooking liquor measurements were included in the delivery. To unleash hidden potential, Metso also carried out a performance audit. In the next stage, the mill will have a Cooking Optimizer and a Kappa analyzer installed.

“We have a long association with Metso. They have recently upgraded our cooking and fiber line at our SFI plant in Malaysia and are now working with us on our pulp mill modernization project in Ballarshah,” says R.R. Vedera, Managing Director & Executive Vice-Chairman, BILT.
Brigl & Bergmeister enhances its label paper quality

Brigl & Bergmeister, one of the world’s leading manufacturers of papers for labels and flexible packaging, will upgrade its existing Metso quality control system at its Niklasdorf mill in Austria. With its modernized quality control system, the mill will be able to further enhance the quality of its labels that are found on world-renowned beverage brands. The investment will also extend the life cycle of the whole label paper production line.

“Our papers wear the face of countless familiar brands. The customer’s first contact with a branded product is often the label or the packaging, made of our paper. A label is much more than an information carrier; it can enhance a product’s lasting success,” says Michael Sablatnig, Managing Director of Brigl & Bergmeister.

Single system architecture saves costs and effort

Automation-related technology cooperation between Brigl & Bergmeister and Metso goes back several decades and has covered several automation and quality control system generations. Metso also provides the company with a wide range of professional automation services locally.

Today, the mill runs its functions on a single automation system, Metso DNA. The single system architecture saves on both costs and effort, ensuring open growth for future challenges at the same time. The modernized quality control system will be installed on the same automation platform.

“We prefer to cooperate with Metso because they ensure the best compatibility between their state-of-the-art technology and our existing equipment,” adds Wilhelm Fandler, Electrical Manager at Brigl & Bergmeister.

Metso will modernize five Metso IQ Scanners and equip them with Metso IQ MD and CD Controls on PM 3 and the coater. The delivery will also include a Metso IQ Dilution Profiler for the PM 3 headbox.

Metso’s automation to run Asia’s largest-capacity biomass power plant

Metso’s advanced automation technology for difficult fuel mixes enters South Korea.

GS Engineering & Construction Co., Ltd. (GS E&C), has chosen Metso to supply automation for the Dangjin 4 Biomass Power Plant, currently under construction in Dangjin City, about 70 km southwest of Seoul in South Korea. Once completed in 2015, the 105 MW plant will be the largest of its kind in Asia.

With the new biomass power plant, owner GS E&C aims to enhance its competitiveness in the power market, increase its electricity capacity and produce more renewable energy. “We chose Metso because the company has many references from demanding biomass-fired power plants. It also fulfilled our technical support requirements,” says Gye Man Jeong, General Manager, GS E&C.

The plant will be fueled with a mix consisting of 80% palm kernel shells and 20% coal. With Metso’s advanced automation applications, it is possible to control even difficult fuel mixes with varying fuel ratios.

Metso’s delivery scope includes a Metso DNA automation system (DCS) for the whole power plant, including the CFB boiler, Balance of Plant and electric network. It also includes a Plant Performance Application and systems for thermal stress monitoring and vibration monitoring – all integrated into the control system. Commissioning of the new plant is planned for August 2015.

“With this order, Metso enters the Korean energy market. The importance of this reference cannot be emphasized enough. Upon the successful delivery of this project, Metso will be recognized among the Korean EPC contractors as a potential supplier for power plant automation systems,” says Matti Mälalainen, Director, Energy & Process Systems, Automation, Metso.

Brigl & Bergmeister, one of the world’s leading manufacturers of papers for labels and flexible packaging, will upgrade its existing Metso quality control system at its Niklasdorf mill in Austria.
Metso’s biomass moisture analyzer wins esteemed iF design award

Metso’s biomass moisture analyzer has received the esteemed iF design award in one of the world's top product design competitions. The jury recognized the product for its design quality, degree of innovation, environmental impact, functionality, safety and branding, among others.

"The design features competitive and easy-to-use fuel moisture measuring equipment coupled with a user interface that can be used in multiple surroundings," says Arvo Rahikkala, Business Manager, Power and Minerals, Automation, Metso.

With Metso MR Moisture Analyzer, it is possible to accurately measure the moisture content of virtually any bulk material, such as wood-based samples (whole-tree chips, forest residue chips, peat), annual fibers (straw, grains, willow), minerals and sludge, regardless of the material quality or particle size. The fast and reliable moisture measurement is applicable to pulp and paper mills, minerals processing plants as well as power plants to optimize their operations.

More accuracy, less effort and lower costs

"Improved moisture analyzing technology brings significant benefits, for example, to biofuel power plants where fuel moisture is the main property measured. By measuring moisture more accurately, power plants can more accurately determine the true heat value and heat value-based price of incoming biofuel," Rahikkala points out. "This is key to evaluate its true energy content and value in order to optimize boiler operation for enhanced productivity." Compared with conventional oven drying that requires both resources and time to provide accurate results, Metso MR Moisture enables power producers to attain a fast and reliable moisture measurement with less effort and lower costs. Metso MR Moisture is the first industrial moisture measurement application utilizing magnetic resonance technology to measure the water content by measuring hydrogen atoms from free water molecules.
Neles control valve offering extended

Metso’s Neles control valve offering has been extended to meet increasing demand for severe, erosive applications in the oil and gas industry, such as slurry handling, in traditional pulp & paper processes, and in mining and minerals processing.

The portfolio of Neles® ceramic E-series control valves, recognized for being extremely erosion resistant, has now been expanded to NPS 08” (DN 200) in pressure Class 300 (PN40).

The E-series valve is the most erosion-resistant control valve available. It works as an ideal solution in many energy and hydrocarbon processes, as well as in mining and minerals processing processes, where metallic materials and coatings fail due to high erosion. Catalyst handling can be a challenging application.

The new offering meets even the most severe, erosive service requirements with improved process efficiency.

With the E-series control valve, plant runtime can be extended and life-cycle costs minimized.

Pulp mills with capacities of up to 1.5 million tons have been able to utilize this new valve size as part of their latest process investments to meet the demand for severe control applications and to reach larger dimensions.

The Neles ceramic control valve series E2/E6 uses a field-proven design with solid ceramic trim components to cover the whole wetted flow passage.

Metso’s Neles capping valves give Stora Enso Nymölla mill an automated solution for its demanding batch cooking process

Stora Enso Fine Paper’s Nymölla mill in Sweden selected Metso as the supplier of new capping valves for its batch digester line 1. In total, Metso will deliver 5 Neles® PZ-series capping valves to replace the mill’s old hydraulic cappers. This gives Stora Enso an automated solution for its digesters, replacing old valves and actuators that needed manual assistance in the chip filling phase and increasing overall productivity.

The Neles PZ series of capping valves improves process safety, enhances process reliability and eliminates unscheduled process downtime thanks to its proven technology. Design features, like a preloading device mounted outside the valve body, prevent chips and liquor from causing hazards. Special interlocking systems, essential to plant safety, help lower maintenance costs. The Nymölla mill’s batch cooking process is a very demanding application because magnesium bisulfite is used as a cooking liquor.

The local Metso sales and product line teams were able to offer Stora Enso Nymölla mill a solution that fulfilled their requirements by making a few technical changes to the standard Neles PZ-series capping valve design. These details were thoroughly discussed with the customer. Technical compliance, together with a proven track record in similar applications around the world, helped Stora Enso Nymölla mill decide in favor of the new capping valve solution. The Nymölla mill specializes in producing high-quality office papers and has had a good working relationship with Metso already for decades. Today, the whole mill with two paper machines is equipped with Metso’s automation system Metso DNA, Metso IQ quality control system, NelesACE basis weight valves and a range of profilers, which are fully integrated with Metso DNA. The new capping valves will also be connected to Metso DNA.

The valves for this project will be delivered during 2014. All valves are scheduled for installation and commissioning by the end of the second quarter of 2014. The delivery contains 5 Neles PZ capping valves equipped with pneumatic actuators, control centers and Neles SwitchGuard intelligent on-off valve controllers.

Long history in capping valves

The capping valve is one of the innovations for the pulp and paper industry that originated from Metso. More than 1,500 capping valves in total have been delivered to batch cooking applications worldwide. The first capping valve deliveries to Sweden were made during 1969, and Metso has continued its valve deliveries and related services in the country since then.
Mondi’s Ružomberok mill in Slovak Republic aims

Mondi SCP a.s. has placed an extensive order with Metso for advanced automation technology for its Ružomberok pulp and paper mill in the Slovak Republic. The mill is building a new recovery boiler and a turbine, as well as extending its evaporation plant and lime kiln, which will be run with Metso’s automation system. High-tech automation contributes to lower costs, raw material usage, energy consumption and environmental load, while enabling the mill to achieve its targeted quality and performance.

“We chose Metso’s solution in order to take advantage of synergies with our existing mill environment, making use of the knowledge of our professionals and operators, as well as minimizing side costs. Another factor that supported our choice of Metso as a supplier was our good experience and cooperation in the past,” says Michal Legersky, Project Manager, Mondi SCP a.s.

With better process control, the mill can improve its overall performance and decrease its environmental footprint.

Automation supplies to Abu Dhabi, Algeria, Brazil, Croatia and China

CMPC Celulose Riograndense’s Guaíba II pulp line in Brazil will utilize Metso’s integrated automation solution.

The new pulp line, which is an expansion to the existing Guaíba pulp mill, will have a capacity of 1.3 million tons per year and will be able to reach 1.5 million tons per year with minor investments. The new pulp line will be built in the state of Rio Grande do Sul in southern Brazil and is scheduled to be commissioned in the first half of 2015.

Metso’s automation solution for machine, process and quality controls will be supplied to Faderco’s new tissue line in Algeria. The startup of the tissue machine is planned for the second quarter of 2015. The automation package includes Metso DNA machine and process controls and Metso IQ quality controls.

The tissue production line will have a design capacity of around 30,000 tons a year of high-quality facial, toilet and towel grades. The raw material for the new lines will be virgin fiber.

Results Automation
Complete Metso DNA system included
Metso’s scope of delivery will include a complete Metso DNA automation system for the new recovery boiler 3 and the turbine, the evaporation plant and lime kiln extension, as well as for the upgraded operator stations in recovery boiler 2. The delivery also includes application engineering and commissioning.

“The mill already has Metso DNA in all other areas of the recovery island, so the operators are familiar with the system,” comments Udo Schober, Area Sales Manager, Automation, Metso.

With production exceeding 474,000 tons of pulp and 535,000 tons of uncoated paper, Mondi SCP is the largest integrated mill producing paper and pulp in the Slovak Republic. Over 77% of its production can be identified as “green” since the energy used for its production comes from biogenic resources while the wood comes from certified, well-managed forests under FSC™ and PEFC schemes. The increased volumes of production thus work in a synchronized way while continuously decreasing the mill’s footprint on the environment.

The Croatian Uni Viridas’s new biomass fired power plant is scheduled to be in operation in 2015. The plant automation will be based on Metso DNA technology. The plant will have a power output of 9.7 MW and a heat output of 10 MW. The electricity will be distributed to the local grid and the heat will be utilized in a wood pellet factory, other industrial facilities, and nearby greenhouses.

Metso’s automation solutions for machine, process and quality controls will be supplied to Abu Dhabi National Paper Mill’s new tissue line in the United Arab Emirates. The tailored automation solutions will enhance total performance and keep production in peak condition. The new line is planned to start up in the second quarter of 2015. The new tissue line will boost ADNPM’s current production capacity of 63,000 tons to 93,000 tons a year of high-quality facial, toilet and towel grades.

Chinese Zhejiang Jingxing Paper’s new containerboard line will utilize Metso Automation’s dilution headbox controls. The new line is targeted to produce high-quality containerboard grades from 100% recycled raw materials. The startup of the machine is scheduled for 2014.
We put thought into your pulp and paper processes

While automation accounts for just a fraction of the overall mill investment, it is that optimized control that ensures that the entire mill performs up to expectations and beyond.

Metso’s automation offering is all about added value

**Improved profitability**
- Energy efficiency
- Raw material efficiency
- Optimized product quality
- Labor efficiency

**Optimized process**
- Quality
- Consistency
- Reliability
- Predictability
- Safety

**Long-term performance**
- True solution scalability
- Industry-leading product portfolio
- Comprehensive services
- Continuous R&D

Metso’s dedication to the pulp and paper industries
- Over 50 years of history and experience in pulp and paper
- Dedicated and experienced personnel on all organizational levels
- In-depth understanding of processes and business environment
- Continuing cooperation with machine manufacturers
- Commitment to excellence, innovation and continuous development
Automation’s solutions and services help pulp and papermakers unlock business value over the lifetime of their investments by improving productivity, energy and material efficiency, optimizing costs and end product quality, as well as enabling more effective risk control.

“We have a unique combination of process, machine and automation know-how as well as the right product and service portfolio supported by a worldwide network of automation experts,” says Sakari Ruotsalainen, President, Process Automation Systems business line. “Our committed professionals, long experience and in-depth expertise ensure that every project is carried out on time and within budget, every step of the way.”

**True pioneers**

Metso has the world’s widest scope of automation solutions and services for pulp and paper — from single measurements to mill-wide turnkey automation projects. With over 50 years of experience, Metso knows the

**The benefits Metso offers pulp and papermakers**

- Optimum process efficiency
- Lowest raw material, energy and production costs
- Minimum waste during startups
- Required quality for demanding end users
- Maximum process and machinery uptime
- Improved labor efficiency and operator effectiveness
- Lowest cost of ownership over the equipment lifetime
- Continuing and increased results through worldwide expertise and local support
- Excellent return on investment

The world’s most profitable pulp and paper operations run with Metso’s automation solutions
challenges of pulp and papermakers inside out and has developed optimal solutions for mills to overcome them and run profitable operations.

Metso has been a pioneer in developing the industry’s most comprehensive automation offering based on single-network thinking. This means that all automation system components – process controls, machine controls, quality controls, drive controls, information management, condition monitoring, web-break analysis and inspection, and process optimization, as well as analyzers, measurement instruments and valves – are all implemented within the same environment. Metso’s state-of-the-art solution to achieve this is the Metso DNA platform featuring high usability.

Many valve innovations for the pulp and paper industry have originated from Metso, such as the capping valve and the basis weight control valve. During the past 60 years, these valve solutions and related services have been the preferred choice of global pulp and papermakers. This is proven by the fact that 75% of the world’s pulp flows through Metso’s valves. Metso has also been a front-runner in bringing online diagnostics to valve operations.

Metso has enabled customers to gain results in both greenfield and brownfield markets by developing and supplying cutting-edge technological solutions. Since 2009, for example, Metso has automated more than 60 new tissue and board lines, delivered more than 600 new quality control systems (QCS) and profiler systems, and replaced more than 170 QCSs and profilers manufactured by other suppliers.

During the same time period we have supplied more than 100,000 control and automated valves, including more than 300 Neles Ace basis weight control valves and more than 50,000 Neles ND9000 digital valve controllers as well as about 100 capping valves for batch cooking process.

**Constant improvements**

Metso is investing even more in developing better solutions for pulp and paper customers and intends to further strengthen its position by further widening its offering.

One of the newest additions to the portfolio has been the introduction of the Metso ExperTune PlantTriage product and Control Performance solution built around it. This product and associated service examines a production system, identifies any underperforming controls based on economic impact, identifies the root cause and proposes a solution. Root causes can range from process design issues, valve under- or oversizing, and faulty equipment to incorrect parameter settings. As a result, plant efficiency is compromised. Just getting the controls working correctly can create hundreds of thousands of Euros in savings, even before optimizing the process level.

“Our strength is based on two factors that are tightly connected to each other: experience and reliability. We have extensive knowledge and experience from pulp and paper processes and applications. And this expertise has been built into our product offering,” says Esko Ilmonen, Vice President, Flow Control, Pulp & Paper Sales and Marketing.
Tailored, value-adding and intelligent services

Metso’s goal is to be the automation partner of choice for pulp and paper customers who want to optimize their production. “In addition to traditional services to solve our customers’ technical and process issues, we provide them with services to improve their business performance,” remarks Mikko Keto, President, Services business line. “Our Business Solutions focus on three critical areas of production: maximizing availability, enhancing production performance and controlling business risk. Our services provide support, for example, with issues related to maintenance or safety wherever possible, irrespective of the automation system supplier.”

As skilled staff retires or resources diminish for other reasons, mills often have no one to keep automation running at top level. In cases like this, Metso can also take full responsibility for a defined area, such as valve or quality control system maintenance, through its Managed Services.

“Today’s pulp and paper producers expect Metso to help them optimize the maintenance of their automation assets. They have a target system availability in mind and want to lower operations and maintenance costs while still hitting those targets. We offer three solution areas that can help: Customer Care, Intelligent Maintenance and Lifecycle Management,” Mikko continues.

The intelligent Maintenance concept is about focusing maintenance on those areas where it is actually needed. So instead of just maintaining equipment at set time intervals, the Metso approach is to monitor the condition and adapt maintenance schedules depending on usage and wear. If wear is more than expected, maintenance can be brought in earlier to avoid production outages. If wear is less than expected, the period can be extended, thereby reducing maintenance costs.

“Some of the best examples of what this means come from the maintenance of valves in pulp mills. In a typical pulp mill shutdown, we avoid having to remove around 60–70% of the valves by analyzing the valve condition in advance, which results in significant cost reductions in comparison to what our competitors provide. When we repair an item, we make sure it is repaired according to the original manufacturer’s guidelines so that the repaired item can function like new and have a long operational life,” Mikko Keto explains.

Close to customers around the world

Although technology and services are important, so are the skilled people who provide them. Metso has over 1,000 service professionals in over 30 countries around the world. There are well over 50 Automation Service Hubs and more than 35 Valve Service Centers to support local teams and cater to the needs of pulp and papermakers.

In 2013, Metso’s pulp, tissue, board and paper machines, as well as power generation boilers and related services, formed a new company, Valmet. Metso and Valmet continue to cooperate so as to maximize the benefits for their customers. Automation is also continuing to collaborate with and offer solutions, equipment and services to other providers of pulp and paper machinery and processes.
Burgo Ardennes stabilizes bleaching process, reduces cost

Metso’s Bleaching Optimization solution smooths out bleach plant operation and demonstrates an 8.7% savings in bleaching chemicals with improved brightness stability. The results have been achieved and augmented by a thorough process analysis study by Metso, expert implementation of new process measurements and advanced controls, remote analysis and recommendations by Metso to improve control and results.

TEXT: Mark Williamson

Faced with a difficult-to-control process and high bleaching chemical consumption, Burgo’s Ardennes mill in Belgium contracted Metso to update its measurements and controls to achieve better process stability, consistent quality and lower costs. And that has been accomplished through Metso’s expert Bleaching Optimization services. Moreover, through a continuing services agreement, Metso has kept performance on track and actually improved some process stability issues since the original commissioning. The mill lists its capacity as 360,000 tpy, but that has recently been increased to 400,000 tpy, all of which is for short fiber papermaking applications, either used in the integrated coated paper mill or sold to external customers. The final brightness targets range between 88 and 90.

The wood species used at the Ardennes mill are poplar, beech, birch and oak, and this mixture presents a challenge for bleach plant operations. The bleaching of mixed hardwood pulps is a very difficult task as the differing delignification and brightening characteristics of various wood species are added complications to the naturally complex chemical reaction process. Effective control implementation requires some in-depth knowledge of the process and how to deal with disturbances. Bleaching process stability and efficiency is influenced by many process variables that can affect the reaction rate, chemical consumption and final pulp brightness endpoint. Therefore, the measurements and the controls have to be in top-notch working order and tuned to perfection to get process stability and the target quality with minimum chemical dosage.
The improvements at the Ardennes mill have been achieved by a successful measurement and control implementation using new Metso analyzers and Bleaching Optimization services that have demonstrated a substantial saving in bleaching chemicals with a much more stable process. Most importantly, the stability has been maintained after the project was completed in the summer of 2013 by a continuing Performance Service Agreement (PSA). After the initial commissioning, the controls have been adapted to significantly higher production rates later in the later part of 2013. Remote diagnostic reporting has pointed out some process improvements that were implemented with positive results. The improvements in chemical utilization are continuing.

Tailor made controls
Eric Bazzoni, Fiber Line Production Manager, sums up the mill’s objectives and the results achieved: “Before the new controls, it was difficult to achieve higher brightness targets for some customers. We were having problems with process stability and high chemical consumption. Our goal with the new measurements and controls was to stabilize the process and reduce costs. Now, we have a big advantage as we can achieve the right brightness even at higher production rates. Before, it was difficult to achieve stability from shift to shift as operators would manually change parameters. Now, the control system adjusts by itself and the parameters are the same. We do not have any off-specification pulp.” He points out that chemical consumption is kept to a minimum since the
The improvements at the Ardennes mill have been achieved by a successful measurement and control implementation using new Metso analyzers and Bleaching Optimization services that have demonstrated substantial savings in bleaching chemicals with a much more stable process.

chemical residual of chlorine dioxide after the bleaching towers is at a very low level. He says there are no problems with off-gassing that might cause health, safety and environmental problems.

Pierre Carnevali, Mill Projects Manager, adds his thoughts on the controls implementation, “I am impressed that the Metso engineers have adapted the controls to our own process. For us, it is a tailor-made control for our own mill.”

Project scope defined by audit
The project scope was defined by a Metso measurement and controls audit requested by the mill. The process study defined the measurement and control requirements and the agreed control guarantees for final brightness stability and reduction in chlorine dioxide consumption.

The study concluded that many of the process measurements were obsolete and needed replacement with modern versions. The Metso engineers also recommended some changes in the measurement scheme that would improve process controllability.

François Zune, Burgo Process Engineer, says the most significant recommendation was to change the pulp Kappa sampling point from after the B stage (or D stage) chemical mixer to before the mixer. This would provide a more responsive feedforward control.

The new measurements included a Metso Kappa Q for online Kappa measurement at five sampling locations, three new Metso Cormec5 inline brightness measurements and three new pH measurement points that include a Metso Filtrate sampler. The new filtrate sampler provides a clean sample to the pH probe and thus avoids fouling and measurement instabilities that are common to the previous inline measurements. Metso engineers implemented the Bleaching Optimization using advanced process control (APC) tools in order to optimize the stability and costs of the bleaching operation. The process measurement points are shown in Figure 1 (on page 15).

The control strategy automatically manages delignification (as measured by Kappa) and brightness to achieve the final brightness target in the most cost-effective way. This is done by avoiding over-consumption of the bleaching chemical. In dioxide stages, adding more chemical past a certain optimum point no longer produces a corresponding brightness response. In many cases, the chemical dosage is kept above this optimum limit in order to ensure that the brightness target will be achieved. This is typically what operators do in a manually controlled operation as Burgo had. When the standard deviation of brightness is reduced due to more effective process control, this “safety margin” can be cut. This results in significant chemical savings.

The control guarantees were tested in the summer of 2013, and the results were better than the guarantees. Brightness variability was reduced by 47.9% and chlorine dioxide consumption was reduced by 8.7%. The project was accepted.

The Kappa Q Analyzer takes online samples of pulp from five points in the process.
Optimization continues

But this was not the end of the task to maintain and improve the controls. The mill planned to increase production from 1,015 tpd to 1,100 tpd. This would affect the residence time in the bleaching towers and hence change the dynamics of the bleaching chemical reaction. With a shorter residence time, the consumption of chemical went up as expected. Metso retuned the controls for the shorter residence time and different control dynamics. The controls were retuned to give the original and expected process stability. This was done under a continuing Performance Service Agreement that includes an annual site visit for control issues. To keep the important measurements in good working order, a Preventive Maintenance Agreement contract for Kappa Q and other fiber line measurement includes several visits per year.

The Performance Service Agreement includes remote system and process monitoring through a link to Metso and 24/7 telephone help services. The service monitors the bleaching process performance stage by stage and issues daily and monthly control performance reports. Bazzoni finds this a useful tool as it gives a concise report on key control objectives and uncovers any problems. Carnevali adds: “The reports tell us if we are in a good control range or not and if we are consuming the right amount of chemicals.”

Even after a short time, this service proved its worth by detecting a problem, as François explains. He says that a process temperature regulation problem was detected by the remote link to Metso. Temperature has a significant impact on reaction rate so this problem had to be fixed to improve stability. This was done and the bleaching is more stable.

The optimization process continues. Metso has recommended that the B stage pH could be reduced to save bleaching chemical further. The preliminary results look promising. FRP piping has been installed to avoid corrosion at the lower pH levels. Control tuning has continued after the end of March 2014.

François says that the mill people have learned a lot about bleaching control from Metso. The remote and telephone help services enable problems be quickly detected and corrected. “It has opened our eyes,” he concludes.

The mill will continue to improve its operations with the installation later this year of Metso’s Causticizing Optimization along with a Metso Recovery Analyzer, which measures key chemical concentrations in the process. The goal is to stabilize and increase causticizing efficiency, stabilize residual carbonate levels and reduce fresh lime consumption.
Faced with an automation upgrade at its Délipapier plant in Frouard, France, Sofidel took the advanced step of virtualizing the control and quality systems on tissue machine 1 as well as the water treatment plant.

A traditional upgrade would have involved a substantial investment to replace computer hardware and automation infrastructure with basically an identical, albeit newer, system. Replacing the many servers or PCs in a distributed system not only alleviates questions of reliability and spare part availability, but also addresses the ability of using newer software to take the latest advances of automation technology into use. Virtualization allows the physical computer hardware to be separated from the software by creating Virtual Machines (VM) in a host server to provide a much more fault-tolerant and stable environment for critical applications. This solution significantly reduced the computer hardware required in the upgrade and lowers the expense of maintaining multiple operating platforms in the mill.

A world first
Sofidel started with virtualization in converting. For Fabrizio Lapucci, Corporate Automation Manager at Sofidel, this area had the most problems. “Today we have completed this technology initiative at all of our European converting lines. We started on virtualization for tissue production with Metso because of our long experience with the company and confidence in Metso’s control and quality systems expertise to meet the many challenges of duplicating all the functions in a virtual machine.” The DCS and QCS upgrade at Délipapier provided Lapucci with the opportunity to realize the world’s first virtualization of a process and quality control system on a tissue machine. A third member of the project was Ergon s.r.l., the Italian systems integrator that had worked on the earlier converting virtualization projects. According to Lapucci, “Ergon has the virtualization expertise. We know the process and Metso are the automation experts, a good combination to meet the challenge. The virtualized environment enables the replacement of many computers to make everything easier – better maintainability, higher availability, easy to make backups or clones of the different machines and apply security/virus updates. The reduction in computer hardware and reduced electrical power needed also further lessens the environmental impact of our operations.”

Délipapier started tissue production in 1999 with a full automaton
solution from Metso, which has remained in operation to the present day. After more than 12 years since startup, the mill wanted to upgrade the still reliable existing control system to benefit from the latest available process and system improvements. After a deep automation life-cycle study at the mill to access availability and production targets, Metso’s new generation automation and information platform Metso DNA was selected. The new automation solution from Metso would increase the stability of the tissue-making process, improve production efficiency, provide enhanced process visibility and operability, as well as offer better production and process data communication, reporting and alarm handling. The non-nuclear Metso IQ Fiber Weight Measurement was also included in the quality control system upgrade. According to Lapucci, IQ Fiber fits perfectly with Sofidel’s environmental policy by eliminating the nuclear basis weight sensor with its specialized safety and personnel training requirements. “The use of an infrared sensor rather than nuclear is much closer to our idea of being green,” says Lapucci. “This is already the sixth successful IQ Fiber installation in Sofidel paper mills since the first in 2010.”

### Virtualization technology
Metso achieved the virtualization solution with VMware technology. VMware, Inc was the first to introduce the benefits of virtualization to industry-standard x86-based platforms and is today the market leader.

This solution significantly reduced the computer hardware required in the upgrade and lowers the expense of maintaining multiple operating platforms in the mill.

The earlier Windows NT based systems at Frouard for stock preparation, process and machine controls, engineering and water treatment control employed several servers distributed around the mill with literally miles of interconnecting cables, numerous interfaces and many duplicated hardware resources. This approach stems from the architecture of today’s x86 computers, which are designed to run just one operating system and application at a time.

As a result, the many servers each operate at a small percentage of their capacity, which is highly inefficient as well as multiplies the possible rate of hardware failure due to network complexity. VMware virtualization software solves the problem with several operating systems and applications running in one physical server or host. Each self-contained virtual machine is isolated from the others, and uses as much of the host’s computing resources, such as data storage, as it requires.

### Intensive cooperation
The VMware virtual machine server underwent Metso’s stringent Factory Acceptance Tests (FAT) in Tampere before installation. Performed by Metso specialists together with Sofidel personnel, these tests were the culmination of several months of intensive cooperation between Metso and Sofidel in the project. The actual installation, according to Fabrizio
Lapucci, went very smoothly, “Like velvet,” he says. “With only three days needed, including the installation of the new scanner and IQ Fiber Weight Measurement.”

In the control room, network complexity was decreased with just three thin client computers replacing the earlier PC-based operator stations. The thin client is basically a low-end computer terminal that only provides a graphical user interface to the virtual machine. The use of thin clients to access the virtual machines provides multifunctional capability for each operator station depending only on the log-on identity used. This provides built-in redundancy to the system in the event of a problem with control room hardware. In addition, wireless access to the system is possible with a laptop or tablet computer from anywhere in the mill.

The main server, hosting the virtual machines is located in the cross-connection room with another duplicate server in the mill’s office server room. In the event of a catastrophic server fault, the second server takes over control almost immediately. This has not yet happened in normal operation but has been tested by literally pulling the server power plug from the wall. Changeover to the second server was almost unnoticed by the operators with full functionality to the DCS, QCS and water treatment being restored in less than seven seconds. This is very different from the earlier situation, where a server would need to be physically replaced in the event of a fault.

In the cross-connection room, the existing VME stations were replaced by modern Metso ACN controllers, each with two process stations. The new process stations require a lot less cabinet space than the previous six VME stations and occupy a single cabinet next to the virtual machine host server. The original I/O installed in 1999 was retained, with a total I/O count of 3,517, 2,658 for PM 1 and 859 for the water treatment plant, where fiber optics connect to the outlying equipment. Water treatment plant operation is now visible from both the new virtualized control room of PM 1 and the VME-based control system still in use on PM 2. Two fiber optic rings provide redundant communication between the control room and server room as well as other parts of the mill.

**Production visibility**

For Production Manager, Stephane Bonnet, the main result of the virtualization project is a new DCS and QCS: “For me, the new tools are really nice but I don’t need to be familiar with the technology behind them. Everything is fine, and there have been no problems. It looks very compact and is very reliable, so for me and the operators, it is transparent. After just one week, the operators were familiar with the new system and comfortable with the operation.” New tools to improve process visibility include DNA Historian, a high-performance data management system that collects real-time process data, including all measurements, set points, controller outputs, device statuses, motor starts, alarms and operation tracking to the history database. According to Bonnet, “We have immediate access to details about a problem whether it occurred at the weekend or six months ago. We use it all the time to improve the process. Recently during a problematical color change, it made it easy to see that a small mistake had been made with consistency and in the future we will be able to avoid that. Previously, this problem with a consistency set-point would not have been seen. Now we know what to do and have changed procedures for future color changes. Improvements like this have a big impact on our production.”

**A 15-year jump**

Lapucci has been really satisfied with the project: “With the new DCS and QCS, the latest software and the advantages of virtualization, everything is going in the right direction, and we are pushing the automation as much as we can.” Applying the latest technology also provides big advantages in maintaining the system with VPN remote connections available for Metso to help manage the software and measurements, as well as for Ergon to maintain the server structure. “This is very important to maximize the system effectiveness,” says Lapucci. “An additional advantage is that the servers are now located in a clean and controlled environment, which will maximize their service life.”

“From a time when there were no smart phones or tablet computers, we have made a 15-year jump in automation technology. For our paper producers, it is no longer science fiction but reality,” concludes Lapucci.
Fabrizio Lapucci extends his thanks to the team that made this project possible. Their efforts were essential to the successful outcome of this automation challenge.

**Sofidel S.p.a., CTO department:**
- Leonardo Rocchi
- Simone Capuano
- Libio Vannucci

**Délipapier SA, IT department:**
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- Aulis Kylanpaa
- Tero Hakala
- Perttu Kotiluoto
- Matti Hasari

**Ergon**
- Matteo Franchi
- Andrea Trubbianelli
- Francesco Ciacci

Délipapier belongs to the Italian group Sofidel, which is the second largest manufacturer of paper for hygienic and domestic use in Europe. Sofidel was established more than 40 years ago and operates today with 27 subsidiaries in 13 countries.
Product and process innovations are becoming more and more important in the packaging industry. The principal objectives are to improve process flows within production and to make efficient use of resources, especially considering the rising pressure in terms of both costs and competition. While end consumers are increasingly encouraged to buy through visual means, such as attractive packaging, the packaging specialists have to deal with the fact that raw materials are becoming both more expensive and scarcer. In short, the market is fiercely competitive, but at the same time, offers good opportunities for companies that can face current and future challenges with technologically efficient solutions.

Two areas in particular are the cost drivers in paper manufacturing: raw materials in the form of wood or recycling paper, and the generation and consumption of steam for the steam and condensate system. At its Trostberg location in Bavaria, paper specialist Hamburger Rieger produces white corrugated board and Rieger Liner DC test liner, and just like the product, both the raw materials that are used and the production methods applied are the top of the range. Hamburger Rieger skillfully combines tradition, innovation and expertise to achieve a high level of quality, which ensures success for both the company and the customers for its paper in equal measure. The “RiegerLiner” brand paper leaves an impression...
Hamburger Rieger’s Trostberg plant is located in the center of the town of Trostberg on the river Alz in Bavaria.

Photo: Hamburger Rieger

with its consistently bright white surface, offering maximum sheen and ideal smoothness.

The coated white top liners with basic weights of 120 to 230 gsm are produced on the PM 2, a four-layer Fourdrinier machine that was developed in 1992 as an innovative conversion of the previous BM 1. With an operating speed of 1,000 meters per minute, PM 2 produces 140,000 tons of coated paper a year. Excluding scheduled downtime for one major service each year, the machine runs around the clock, day in, day out. High levels of reliability and availability are therefore indispensable. Every small disruption or web break means lost time and money. This is particularly evident in the dryer section, which accounts for about two-thirds of the entire machine in terms of size, cost and energy consumption.

Energy consumption – biggest expenditure

“A huge amount of energy is needed to reduce the moisture content from 48% following the press section to the remaining 8%,” says Josef Egginger, who is in charge of measurement and control technology in Trostberg. The paper layer runs in slalom fashion over 60 drying cylinders that are driven in groups of a few together and are fed from a steam and condensate system. The biggest single expenditure in a paper mill is on the energy consumption needed for drying, which is also extremely important in terms of achieving a good product outcome. “That is why faultless valve operation plays such an important role in the steam and condensate system,” comments Egginger. “The temperatures of the individual drying surfaces and the pressures on the cylinders have to be controlled with the utmost precision.”

One-and-a-half tons of steam are required to manufacture one ton of paper. The steam is generated in an in-house boiler room and fed by pipes to the paper machine. About 60 control valves ensure that pressure and temperature are precisely controlled, all integrated into a continuous condition monitoring system from Metso. Since 2007, Hamburger Rieger has gradually introduced Neles control valves with intelligent valve controllers of the Neles ND9000 series at its Trostberg location.

The control system on PM 2 has to function reliably, even under adverse conditions. The open system solution offered by the Neles ND9000 valve controller enables it to be added on to valves from a range of manufacturers, and of course with Metso’s Neles control valves, as shown here.

Josef Egginger, foreman at Hamburger Rieger in Trostberg, and Frank Hasenbach-Bauer, Metso Automation Sales Manager, next to the PM 2 during a tour.
Two HART multiplexer gateways have also been acquired, which form the interface between the field device and the computer via the company’s existing network. This enables all of the valves to be monitored online using the Metso FieldCare device and asset management software based on FDT technology and to be configured, calibrated or diagnosed using the associated DTM. “Intelligent technology has obvious advantages thanks to the rapid and easy insight into the system that it offers. We know the current valve performance and condition at all times, even while the process is running. We also had no need for an expensive conversion and no new cabling, which made it easy for us to build the intelligent valve controllers onto the valves,” reflects Egginger.

Automation prevents waste

It is essential to prevent disruptions to the steam and condensate system because these can cause problems, such as web breaks. However, the worst conceivable case would be the complete failure of a valve in the main evaporation zone. This would result in machine downtime lasting several hours, according to the foreman, because the defective components would have to be left for a certain length of time to cool down before they could be replaced, on account of their high operating temperatures. However, insidious faults also have expensive consequences. Thus, valves that open too widely can easily cause a waste of energy if the steam “blows out” instead of being directed to the paper layer for drying.

Depending on paper thickness, production speed and width of the paper layer, about 25 tons of steam per hour is needed to dry the paper. At about EUR 25 per ton of steam, these outgoings rapidly escalate into the millions over the year. The potential for savings in this area can take advantage of using intelligent controls and online monitoring of valve performance. “If steam consumption increases beyond the normal level, the reason may lie in valve or controller malfunction. The only problematic aspect is that this is often an insidious process. Without permanent monitoring, we would have identified these errors only after an actual failure had occurred,” Egginger says.

Troubleshooting at a glance

Josef Egginger knows these challenges from many years of experience. Before the intelligent valve controllers were introduced, staff usually had to deal with the machines at least once a week. The only way to check each individual valve and controller was on-site in permanently high ambient temperatures of about 50°C, air with a high dust content and high atmospheric humidity. “The ND9000 works reliably even under these unfavorable conditions, and most of all, this technology saves us a lot of time and expense. Instead of employing two staff members to spend an hour troubleshooting on the machine, it is now enough for one staff member to spend two minutes on the PC in the workshop reviewing the device status. That has already
REPORTING RESULTS

The “online diagnostics” function of the Metso Valve Manager software provides a rapid overview of the current performance and the nominal and actual valve settings.

Photo: Hamburger Rieger

Neles ND9000 intelligent valve controller
- Preventive maintenance
- Open solution
- Easy to install and configure
- Low overall running costs
- Minimized process deviations

Metso Valve Manager
3rd generation valve diagnostic software
- Online condition monitoring
- Open solution
- Access to all important data
- Open device support
- Multiple communications protocols possible
- Simplified system integration

Metso’s continuous condition monitoring system shows at a glance the device status of about 60 control valves in use and incorporated into the system. This significantly simplifies and shortens troubleshooting procedures.

Photo: Hamburger Rieger

become a habit, just like checking the e-mails in the morning,” emphasizes Egginger.

This quick and easy monitoring and diagnostic capabilities are based mainly on Metso’s 3rd generation valve diagnostics. For instance, the performance view contained in the Metso Valve Manager, the new ND9000 DTM, shows the level of wear to the various components (valve, actuator, valve controller), ambient conditions (supply pressure and temperature) and general control performance in easy-to-follow bar graph form. If performance now worsens, this will be displayed when a warning limit or alarm limit is reached. A report interprets the individual diagnoses and provides the user with indications of the cause and how to resolve the error.

In this way, the information that is supplied supports both preventive and status-based maintenance, as well as allows the appropriate measures and procurement of spare parts to be planned at an early stage. “There is no comparable product on the market. Our employees in the technology area realize what advantages this valve controller and software system offer. In our view, this investment is definitely paying off,” confirms Egginger. “We have therefore set ourselves the goal of fitting all of the valves used in the steam and condensate area with the Neles ND9000 by a process of gradual expansion and incorporating them in Metso’s Condition Monitoring System.”

Frank Hasenbach-Bauer
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As spare parts were increasingly difficult to get, the new IQ Induction profiler was chosen to replace the existing air shower system on the machine calender. According to production manager Vesa Arjanmaa, "As the existing system was old, requiring frequent service actions, the improvement in 2 sigma and faster control response promised by Metso were the key reasons behind our decision." Arjanmaa already had good experience with Metso induction profilers on PM 3 in Kyro together with PM 1 at his earlier workplace in Metsä’s Tako mill in Tampere. "I was confident that Metso could do the job," he said.

Faster response

Kyro BM 1 produces folding boxboard in the basis weight range of 200 to 380 g/m² and, after a recent rebuild by Metso, the annual capacity was increased to 190,000 tpy. Smooth CD caliper profiles are a prerequisite to meet Kyro’s exacting quality standards in the production of folding boxboard for beauty care and other demanding packaging products. The variation of cross-directional caliper is one the most decisive quality parameters for paper and board grades. Large variations, normally expressed as 2 sigma values, negatively affect subsequent converting processes and runnability as well as the visual appearance of the final sheet.
The IQ Induction profiler achieves non-contact heating of the steel roll surface with high-frequency induction, resulting in faster, stable and more accurate cross-direction caliper control. All heating power is efficiently applied directly to the calender roll shell and the resulting heat expansion increases nip load at controlled positions across the width of the machine.

With an accelerated delivery schedule dictated by a planned shutdown in May 2013, the installation, supervised by Metso, was completed on time and results were seen immediately after startup. "We saw the improvement from day one," says Arjanmaa. "It worked as expected and as promised. We achieved a 40% reduction in the 2 sigma variation of CD caliper and in the eight months since startup, we have had no problems."

Reduced breaks
The new CD Caliper control integrated in the Metso IQ CD Controls utilizes a unique approach (patent pending) to address issues such as web breaks and the associated recovery time, during which the amount of broke can be very costly to the mill. After the nip has been closed, changes in geometry caused by the stabilization of the heat flow in the roll can have a negative effect on the caliper profile, especially at the web edges. Active utilization of process information tells the optimization the exact status during the complex transition phase after a sheet break and adjusts the roll temperature to enable a fast return to stable caliper control. Not limited to steady state models, the control stores information from up to 128 previous breaks for the user to check the values of any individual break. According to Arjanmaa, "We have trained the machine crews to use this feature, and it has enabled us to spot problems that would have otherwise caused breaks again and again." Each break recovery can be seen as a trend, and the break susceptibility for specific grades can easily be seen.

Staying ahead
For Arjanmaa, Metso’s skills and technology are appreciated, "We are working in a very competitive market requiring continuous attention to detail. The stability of our product, in both cross direction and machine direction qualities, is vital to our customers and IQ Induction is one of those developments that helps us stay ahead."

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Metsä Tissue Mänttä Mill: A new steam profiler lowered gas consumption and improved energy efficiency

Having had problems with fouling on conventional steamboxes, Metsä Tissue Mänttä Mill in Finland was doubtful about Metso IQ Steam Profiler performance on its PM 10. Well, the doubts have been removed. In addition to better cleanliness, the results include lower Yankee hood gas consumption and improved moisture CD profiles.

TEXT: Marjaana Lehtinen  PHOTOS: Soili Städter

Metsä Tissue, part of Metsä Group, takes sustainability very seriously. The company leads the tissue industry in developing low-impact processes and practices. Its Tissue 20 project, launched in 2008 and completed in late 2012, reached the objective of reducing the use of energy by 20% from the 2007 level. One of the 400 practical measures to improve energy efficiency was the installation of a new steam profiler on PM 10 at the Mänttä mill.

PM 10 is a Beloit machine built in 1969. Its Yankee cylinder was rebuilt by Metso in 2000, and the wire, press and pope sections were rebuilt by Vaahto in 2010. The machine has a trim width of 5 meters and a speed of up to 1,500 m/min. It produces 15–25 g/m² end of its life cycle. Neither we nor any other Metsä Tissue mill had any experience with the new-technology steam profilers,” points out Jyrki Leppäaho, Development and Energy Engineer, who coordinates energy issues at the mill.

Hänninen had had good experience with Metso’s steam profiler technology at his previous jobs – but with board and paper. “I knew that Metso knows how to make steam profilers that function well. But it was a mystery how they would function on a tissue machine,” he reveals.

Maximized steam absorption efficiency
Based on the energy savings guarantees given by Metso and the price, the mill placed an order for a Metso IQ Steam Profiler (IQ Steam Profiler) to replace the old steambox manufactured by another supplier. An additional bonus was the proximity of Metso’s service support.

The compact, curved-design profiler was installed against the suction roll on PM 10’s press section in June 2012. As fouling had been a major problem, the mill chose a Teflon-coated version.

IQ Steam Profiler is a high-efficiency, multi-zone steam actuator system that provides unique profiling accuracy through its electromechanical actuator with position feedback. It features advanced steam injection technology that maximizes steam absorption efficiency and temperature increase, providing very high dryness after the press.

Bad and good steambox experiences
The mill had a not-so-positive experience with conventional steamboxes. There had been steamboxes on all of the mill’s three tissue machines, but two of the three were removed due to fouling problems.

“The only steambox left was on PM 10, and it had reached the end of its life cycle. Neither we nor any other Metsä Tissue mill had any experience with the new-technology steam profilers,” points out Jyrki Leppäaho, Development and Energy Engineer, who coordinates energy issues at the mill.

Hänninen had had good experience with Metso’s steam profiler technology at his previous jobs – but with board and paper. “I knew that Metso knows how to make steam profilers that function well. But it was a mystery how they would function on a tissue machine,” he reveals.

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Total energy consumption decreased
After some initial challenges, energy savings targets – 10% on Yankee hood gas consumption – were reached. Although steam consumption increased a little, total energy consumption decreased
Rami Salminen, an operator on PM 10, appreciates the fact that the moisture profiles are now more even than with the old steambox.

with a 2.5% improvement in dryness. The mill is now able to use less liquid natural gas, which is more expensive than steam and which needs to be transported from a distance to the mill.

“Our investment payback calculations, mainly based on the energy savings targets, have now been reached,” states Hänninen.

Improved moisture CD profiles
In addition to energy savings, the impact of IQ Steam Profiler has been visible as better tissue quality through improved moisture CD profiles. “The new profiler has better profiling capabilities than the old steambox,” explains Toni Valli, Production Engineer on PM 10.

The profiling capability is improved through a specially designed diffusion plate located at a distance of 12 mm from the web and an optimized steambox design. Compared with older units, it is compact, more rigid, and features various features to prevent fiber buildup, avoid cold areas and eliminate drips from condensate on the surfaces or internal water buildup. The most important design considerations are how the steam is directed to the sheet for maximum heating efficiency, reliable control of the steam flow to the profiling sections and how the steam flows within the steambox without any heat loss.

“We do not actually need to utilize the profiler capacity to its fullest to reach even quality. Quality improvement is a positive thing that we get as an additional benefit,” Mikko Hänninen adds.

Improvements in moisture CD profiles have been noticed on the adjoining toilet paper converting lines, too. They now have better runnability and quality.

Fouling is no longer a problem
Fouling is no problem thanks to an automatic cleaning shower also supplied by Metso. It showers the profiler several times a day whenever there is a web break or a blade change, stopping coating color and fibers from building up on the diffusion plate.

“As the diffusion plate is removable, proper cleaning is much easier and faster. We just remove the plate and insert a spare plate into the profiler. We can then let the plate soak in water to remove the dirt buildup. There is no need to grind it mechanically, which would damage the surface,” Leppäaho explains.

The Mänttä mill’s service agreement with Metso for the Metso DNA automation system and QCS now covers the IQ Steam Profiler, too. According to all three men, cooperation and support are good.

A best practice at Metsä Tissue?
As stated earlier, installing the new steam profiler was part of Metsä Tissue’s group-wide program to lower energy consumption. The positive results reached on PM 10 can now be shared with the group’s other tissue mills.

“Experience gained in Mänttä provides a base – a best practice – for other mills to investigate their energy savings potential with new-technology steam profilers,” concludes Mikko Hänninen.

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The aim of the investments was to assure that the operation of the KK 2 bark boiler, the K 12 gas boiler and the TU 7 turbine remains safe and steady. Risk management and safety were the cornerstones of the investment process. The feed water and raw water treatment plants will be renewed this year, during the second stage of the project.

Automation increases plant availability
The Imatra power plant provides the process steam and energy needed for the manufacture of board and paper, which makes the plant essential to Stora Enso’s business. The power plant had used the Metso Damatic XD automation system since 1992, which was now updated with new Metso DNA technology. The old processing stations were replaced with new ones, the process automation applications were updated and the safety systems were renewed. The displays and the automation system control room were also fully renewed.

The availability and controllability of the plant has increased, which extends the
life-cycle of the plant for a good 20 years, Heikki Kangas, Project Manager at Stora Enso Imatra Mills confirms. “The purpose of the project was not merely to update the systems, but to exploit the new features of the advanced applications,” Jari Ehrling, Manager, Customer Service at Metso says. The safety of the machines and people is essential at the power plant. All the automation controls have been designed with the requirements of machine safety in mind.

**Project implementation went as planned**
The project involved updating one of the largest process automation systems of the mills, which was carried out in cooperation between Stora Enso, Efora and Metso. The second stage, involving the water plants, is about to be launched, and it will be implemented during the autumn 2014.

Alpo Pajari, Power Plant Superintendent at Stora Enso Imatra Mills, is happy with the project and says: “The project was implemented according to plans. All startups were executed, without causing losses to the mills. We clearly achieved the goal.”

Some of the factory acceptance tests (FAT) were carried out in Tampere, some in Imatra. Heikki Kangas says that testing in two different locations was well justified, for example, by the schedule. There were more Metso specialists available for the tests during the spring in Tampere. Because the machines were delivered to Imatra in the summer, it was natural to perform the rest of the tests on site. Meanwhile, preparations could be made for the approaching startup. This arrangement also pleasured the people working on the project, as it reduced the amount of traveling required.

One of the keys to a successful project is having accomplished professionals working towards the startup. The updating process of an old plant can take several unexpected turns. Pajari describes: “The heroes of this project were members of the startup team. We needed a range of professionals, from the field and automation personnel to operators. If problems arise, it is important to find solutions, which makes the seamless cooperation of the team vital. This project is a good example of successful organizing.”

What are the benefits of an automation system provided by a sole supplier? Heikki Kangas replies: “The solution is supported by operation and maintenance issues.” According to Esa Hämmäläinen from Efora, it makes controlling and the overall management easier.

**Clear displays with correct information help operators in their work**
The most experienced operative professionals at the mills worked on the project, in order to make the operators’ displays as good as possible. They designed the displays and operations together with Metso and Efora. The procedure increases the users’ dedication to the new system. “This was a good idea,” Alpo Pajari says.

The displays and the automation system control room were fully renewed.
“The operators were familiar with the weaknesses of the old system. Furthermore, they know our processes inside and out.” Heikki Kangas agrees: “It can be seen in the results that the users designed the tool for themselves.” Jari Ehrling adds that including the operators at the design stage shortened the implementation time.

There is one operator on each shift, following the 5-shift system. Operator Tapani Tammela from Stora Enso finds the displays of the new automation system better than the old ones. He thinks the displays were designed well. The implementation was aided by the fact that there was a Metso specialist at the operators’ service 24/7.

According to Tammela, his work has become more efficient and the operation is now easier. Visually well-executed displays are better for the eyes. The operator is now able to monitor the turbine and the steam network better, among other things.

A history database helps diagnose problems
Adopting the new Metso DNA technology also meant taking the extended Metso DNA Operate Trend and Event Archive (TEA) database into use. Alpo Pajari says: “It is easy to find numeric values in the Metso TEA history database. The way the trends are displayed is good. There is ample memory space for wide scale data collection. Operating the trends is effortless. Pieces of data can be selected on the display and dragged to the front for comparative dependency analysis. There is even enough data for process analysis, if needed.”

Efora’s Esa Hämäläinen notes that the history database is useful for diagnosing problems. The database stores data over a long time period. Heikki Kangas says: “The database helps diagnose and assess problems, which will prevent them from recurring. This data is relevant for maintenance activities.”

Operator Tammela explains that searching the history data is easy, which is a clear improvement from the previous system. He monitors steam consumption, flows and pump data, among other.

Turbine automation makes the “black box” unnecessary
The plant’s TU 7 MAN turbine was equipped with the supplier’s Mauell system, dating back to the 1990s, which was now replaced with Metso DNA. The modernization of the turbine control system and hydraulics was planned by Tom Bäckman, Turbine Product Manager at Metso, and the process addressed potential problems in advance. For example, testing the new hydraulic devices was carried out in advance with the Stora Enso spare servomotors. According to Esa Hämäläinen, this test proved to be necessary because it helped identify a problem and solve it in time.

The servomotor was connected to the hydraulics test bench of Stora Enso’s supplier, which meant the servomotor could be tested with both the old and the new devices. Similarly, the hydraulics could be “pre-adjusted”, which prevented potential problems from occurring at the implementation stage and reduced the time needed for the startup.

Tom Bäckman notes that the I/O connections between the old turbine controls and Metso DNA were dismantled, reducing the amount of I/O cards needed. All measurements were imported to the new turbine control and are shown at the operating display. The hydraulics were modernized, which makes it easier to find spare parts. The displays related to turbine controls and protection were also modernized.
According to Esa Hämäläinen, diagnostics has facilitated the detection of faults.

Alpo Pajari describes the previous turbine control and protection system as the “black box”. Its outdatedness was a known risk, because there were no more experts, maintenance or spare parts available for it. Luckily, the old control system did not cause many faults in recent years, as Heikki Kangas notes, but the risk increased every year. Therefore, there was an impetus for replacing the old logistics with the Metso system.

**Predictive measures improve usability**

Metso DNA Machine Monitoring (DMM) is a turbine generator protection system that measures a variety of details in the turbine. “The application monitors, for example, the vibration of the turbine shaft and the bearing blocks, the shaft displacement against the thrust bearing, and the elongation between the turbine chamber and the shaft,” Tommi Karsikas, Application Specialist at Metso, describes. If the vibration level or the shaft position exceeds the threshold values, the system drives the turbine down automatically to prevent major failures. The DMM machine protection (vibration protection) has already been delivered, and the diagnostics unit will follow during the second stage of the project.

In the future, the diagnostics will make the measurement results more decipherable. The measurement results can even be used to analyze the condition of the turbine generator. The delivery will include an application for measuring the startups and shutdowns of the turbine. Esa Hämäläinen believes the availability of real-time data will facilitate analysis activities.

Alpo Pajari emphasizes failure prediction. Predicting and preventing a difficult failure also means preventing the associated risk. Major machine failures may require repair work that goes on for months, Heikki Kangas points out.

**Steam network optimization improves energy efficiency**

Metso DNA Steam Manager, the steam network optimization solution, can be used to control the solid fuel capacity of the KK 2 bark boiler, the load burner capacity of the bark boiler, and the load burner capacity of the K 12 gas boiler, depending on the configuration. Board machine web breaks, in particular, can cause a notable variation in steam consumption, which means the steam production of the bark boiler must be controlled constantly.

Vesa Nieminen, Specialist, Performance Services at Metso, says that the Steam Manager application can control several boilers at the same time, and coordinate the way they are operated. The application reduces the need for more expensive fuel, while employing a dynamics solution that makes controlling faster. Gas load burners can be actively used to control the steam pressure in changes. The Metso application increases the controllability of the bark boiler.

Alpo Pajari is happy with the application that is designed to stabilize the steam network. Pajari says the purpose of the application is to optimize the management of changes caused by steam consumption. Controlling the steam network reduces the fluctuation among boilers. Effective control brings cost savings, by preventing unnecessary bark burning and minimizing the use of natural gas. Any excess steam can be used optimally, which reduces losses. Steam changes are mainly controlled with bark burning in the bark boiler.

Alpo Pajari lists safe operation, reliability and availability as the benefits of optimization. Energy savings are not counted as profits, but the bark boiler and steam network management controls bring considerable savings. Enhanced controls improve steam network management, which saves energy.

Tapani Tammela monitors the steam consumption display in the control room. He sees the status of the boilers, effects of the sheet breaks and peak loads. He says the system enables the optimization of steam consumption, and sees steam network management as an essential element of efficient process control.

**Combustion management was updated and modernized**

The Metso DNA FBB Combustion Manager application optimizes combustion management, with the help of fuzzy logic. It controls the critical combustion parameters, such as secondary and tertiary air flows and fuel feed.

“The old combustion manager of the bark boiler was updated. At the beginning, there was notable fluctuation in the fuel heat value. The aim was to improve combustion control and combustion management,” Alpo Pajari explains. He believes this improves the management of emission levels. According to Jari Ehrling, the optimization is active during startup, which helps achieve the standard level. Afterwards, the controls are adjusted to bring maximum benefits.

In the control room, Tapani Tammela monitors the combustion management, including the amount of air, CO₂ and NOₓ. Air amounts are optimized and controlled, based on the boiler load.

**Mutual trust, partnership**

The outcome of a project has many variables, including human management, interaction, overall project management and the management of risks, resources and costs. A strong supplier relationship is founded on shared experiences, mutual trust and professionally executed projects. Stora Enso, Efora and Metso have executed several projects together, which has made their partnership stronger. The team of Project Manager Tapani Kähkölä became a regular sight at the mill. Regional cooperation is managed by Jari Ehrling and Antti Myller, Application Specialist.

Alpo Pajari says that Metso provided professional staff for the project and the resource management was very successful. The cooperation will continue during the second stage of the project, and with an automation service agreement. Alpo Pajari: “Metso will provide services upon request. In addition, the Metso specialists will be at our service. The focus of the service agreement is on the higher-level controls. When updating the basic automation, it was obvious for us that we should improve the process by investing in control optimization.”

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Enhancing chemicals recovery with a new analyzer concept

Recently, Metso Recovery Analyzer, Metso Metra, was started up in SCA Obbola mill as a part of a causticizing plant upgrade project. Before the project, the mill operated without online analyzers, relying only on manual sampling and laboratory tests. The future plans of increasing pulp production made it necessary to upgrade the causticizing plant. The need for Metso Metra was justified by its ability to provide more frequent process status information using online measurements, thus enabling tools to improve chemicals recovery process management.

In SCA Obbola mill, there is one causticizing line. The recovery boiler is designed for 1,000 tds/day. Green liquor is filtered (X-filter) and then stored in a clarifier. It is possible to bypass the filter and send green liquor directly to the clarifier. A green liquor cooler controls the green liquor temperature in the slaker.

Metso Recovery Analyzer, Metso Metra, is the third generation Metso process titrator especially developed for online monitoring and closed loop control of the recovery boiler and causticizing process. The analyzer is a fully automatic, online sampling and titration analyzer for green liquor, causticizing and white liquor. Using a field-proven online sampling system and autotitrator, it provides outputs for control, based on standard process chemistry titration results. The Metso Recovery Analyzer system consists of a sample unit, with up to 16 sample points, and a measurement unit with one or two titration modules.

As a new feature, the analyzer includes also a unique online reduction degree measurement. With one titration module, the analyzer performs a titration every 7–8 minutes, and a second titration module can halve the analyzing time to 3–4 minutes.

In a typical causticizing application, samples are extracted from green liquor, causticizing vessels and white liquor to digesters. Before analyzing, samples are processed in the sample processing module and lime mud is separated from the sample by sedimentation. Then the sample is pumped into a sample coil, from which a multifunctional burette dispenses it into the titration cup. The analysis is based on the ABC-titration procedure (Standard SCAN 30:85), the most common method in kraft pulp mill laboratories. The analyzer measures the absolute values of sodium hydroxide (NaOH), sodium sulfide (Na2S), sodium carbonate (Na2CO3) and reports effective alkali (EA), active alkali (AA), total titratable alkali (TTA), causticizing degree (CE%) and sulfidity (S%). The additional sodium sulfate (Na2SO4) titration with barium chloride enables the determination of reduction degree.

The measurement results will be available on the visual customer interface at the analyzer and via Modbus or analog connections in the mill DCS.

At SCA Obbola mill, the analyzer measures the process at 5 points using one titration module. The sampling points are green...
REPORTING RESULTS

According to Sandström, monitoring of the process parameters more frequently and in a consistent manner has several advantages and it has been seen that the measurements are exceeding laboratory frequency and precision. “With fast sample testing, the most valuable benefit so far has been the ability to see what is really going on in the process and to be able to detect possible process disturbances at an early phase. Thus, the corrective actions have been able to be performed earlier than before.” The mill does not have automated causticizing control, but still, the recaust performance and results have been improved.

Analyzer delivery to SCA Obbola included the new reduction degree measurement. In general, laboratory testing frequency of reduction degree tends to vary from mill to mill in a scope of once per day to once per month. There may also be a great safety risk involved in sampling because some mills prefer to collect a smelt sample for reduction analysis. Manual sampling and analysis tends to have issues with inaccuracy and large variation in results. With Metso Recovery Analyzer, reduction degree can be measured with such frequency and degree of accuracy, that the information has great value for recovery boiler manager and operators. Also at the SCA Obbola mill, the value of reduction degree measurement is acknowledged. “Now we are able to see how the reduction degree is changing during different process conditions and we can use that information for recovery boiler control,” was a common statement by recovery boiler operators in Obbola mill. An example of reduction degree variation in Obbola mill is presented in Figure 1.

In addition to producing valuable process information, the Metso Recovery Analyzer has been designed in a user-friendly and visually advanced way. A 12-inch touch screen interface provides easy access to see the current operational status and for local operation of the analyzer. The regular maintenance time is also minimal and the entire sample system is self-cleaning. Each sample line is automatically flushed clean by water after sampling to prevent plugging buildups in lines. “Analyzer operating is surprisingly simple and logical,” said Laboratory Engineer Annika Hedman and Nina Hellman, the persons who are taking care of analyzer operation on a daily basis. “All we need to do is to make sure that there are enough titration chemicals available in the containers on a weekly basis.”

Due to its straightforward measurement method and no need for calibration, The Metso Recovery Analyzer is extremely fast to start up. Project leader Kristina Jonsson was able to confirm this: “Startup was fast and smooth, and we were able to get reliable results to operator displays shortly after the startup.” Smooth startup was enabled by good installation and a skillful project group. In the end, the mill staff at SCA Obbola is very satisfied with their new analyzer. Even without automatic process controls, the benefits of the analyzer have been well appreciated in Obbola mill. “Now we are able to stabilize green liquor strength, which helps our operators in lime adding and slaker operations. The operators are also able to see slaker operation feedback from CE% measurements, but all this could be automated with closed loop controls in the future,” stated Sandström. Obviously, the next step would be to introduce optimizing controls to get the full benefits from the information provided by the analyzer, and Thure Sandström agrees with that.

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Figure 1.
Beyond process control to process diagnosis

Pulp and papermakers normally deal with equipment wear, some occasional failures and process instabilities. The analyses, diagnostics and problem visualization functions built into modern DCS and QCS systems help solve these problems for mill teams of operators, maintenance specialists and engineers. The result is better process efficiency and product quality.

TEXT: Mark Williamson

When pulp and paper processes are running smoothly you might get the impression they are on autopilot. However, when the sheet breaks, a machine fabric is lost, something changes unexpectedly or fails, operators must react quickly to return to some state of relative stability. It’s not smooth sailing all the time.

Mechanical components wear continuously or break occasionally, valves deteriorate or malfunction and process unit operations don’t work as they should for various uncontrolled or unexpected reasons. That’s the reality, regardless of the degree of automation. It’s true that automatic controls stay on course during upsets, but any notions of an autopiloted process must be dismissed quickly when operators are faced with mechanical problems, other disturbances from process equipment or abnormal chemical reactions in the pulp mill. There are always problems to work out. These upsets, interruptions or outright failures result in lower productivity and sometimes costly downtime. Worker safety can be compromised as well.

Information is good; diagnosis is better

However, there are remedies to these problems in modern automaton systems. Quality control and distributed control systems have opened up a vital stream of information about the process, the machinery condition and product quality for a more transparent and consolidated view by mill staff. While information is good, diagnosis is even better. That is why analytical and problem visualization tools are now proving their worth by helping mill staff resolve and avoid the recurrence of mechanical, process stability and quality problems. The extensive use of these problem-solving tools underlines the old engineering adage – if you can define a problem, you can usually solve it.

In this regard, DCS and QCS systems have evolved to become much more helpful to operators, process engineers and maintenance staff working as a team. It’s a long way from the times when pulp and paper mills dutifully stored printed production summaries that were seldom used and just gathered dust. Today’s information and diagnostic functions are active, visible and developing as the discussions go on.

With the integration of many more measurements, analyses, diagnoses and problem visualization functions, it is now possible to determine the root causes of mechanical, process and quality problems. Moreover, with the essential input of human interpretive skills, it is possible to prevent them from recurring. By looking out for telltale signs of instabilities or imminent failure and by keeping track of key performance indicators, mills can prepare for necessary corrective actions, nip problems in the bud, and ensure high process efficiency.

Problem visualization

The process of problem visualization started in the 1990s with the integration of machinery controls and interlocks in the DCS system. By displaying the previously hidden logic functions, the causes of halts and startup problems are diagnosed and solved quickly – sometimes by the operators – thereby helping them start up their processes in a prompt and orderly way.

More recently, machinery condition monitoring has been added to the diagnostic capabilities of DCS systems’
Modern automation systems have opened up the process to a more transparent view by mill staff – including operators, maintenance technicians and engineers. Today, many planned or impromptu meetings to solve problems take place in the control room.

In the pulp mill, where instabilities are often related to raw materials and varying chemical reaction rates, fuzzy logic is used to deduce the common sources of process problems and the corrective actions are based on experience. One experienced operator at a Finnish mill said that the indicators of good or bad chip column movement and other performance statistics help the production team to devise new digester operating strategies to continuously improve their operation.

Meeting where the action is

Many of these diagnostic tools are also available on desktop computers where more detailed analysis can be done remotely – away from the hustle and bustle of the control room. However, while individual analyses and discoveries at a desktop computer often shed light on a papermaking or pulping problem, lasting solutions are most often worked out and implemented by a team effort. This involves meetings and discussions – either

allowing operators to see if a particular machine component or bearing is vibrating too much or showing signs of wear. Operators don't need to know the intricate details of vibration analysis; they just need to know that something is abnormal. Then a maintenance technician with specialized vibration analysis skills can be brought in to see if it is serious enough to fix right away or if it's possible to wait until the next shutdown. Some problems – like polymer roll hot spots – need immediate attention, since a failure can come quickly.

Reliability is operator driven

The integration of condition monitoring in the DCS environment comes at a time when maintenance and production departments in pulp and paper mills are developing programs to coordinate their efforts for predicting and planning maintenance activities. The embedded condition analysis function will help mill staff target maximum process availability and cost-effective operations. Rather than being in the corner of the control room or in the maintenance shop, the condition monitoring visual displays are right in the center of action and immediately within the reach of the operators. Christer Idhammar of Idcon, Inc. emphasizes the importance of involving the operators in the recognition of potential problems. He says, "To include operators in essential care of equipment – including preventive maintenance inspections – is one of the reliability and maintenance improvement initiatives that can yield the best return on investment. The investment is low and results in increased reliability and lower maintenance costs can be substantial." This is a major change in operating philosophy, which is often called operator driven reliability (ODR).

Detecting small problems before they are big

Embedded analysis in a DCS also extends to process valves and field instrumentation. The performance of valves can be followed closely, impending problems with their response can be flagged, and maintenance can be scheduled proactively before process stability or uptime is affected. The cost of maintenance is lower since repairs are done only when indicated.

E&I maintenance staff now follow real, just-developing valve problems before they become big ones. For instance, small diaphragm holes can be detected by excessive travel deviations, and these small warning signs can be detected while the process is running before the diaphragm breaks and causes valve failure. Machine shutdowns have thus been avoided.

Process detective work

With advanced spectral analysis, QCS systems analyze the variability of product quality measured online and relate it to process instabilities. In many cases, this detective work by mill engineers can lead to better quality and higher process efficiency. Operators are also presented with two- and three-dimensional representations of online paper quality so corrective actions on the machine can be followed in real time. These color-coded displays alert operators to out-of-spec areas and encourage them to keep quality in the green zone.

In the pulp mill, where instabilities are often related to raw materials and varying chemical reaction rates, fuzzy logic is used to deduce the common sources of process problems and the corrective actions are based on experience. One experienced operator at a Finnish mill said that the indicators of good or bad chip column movement and other performance statistics help the production team to devise new digester operating strategies to continuously improve their operation.

When a vibration alarm is acknowledged and activated by a mouse click on the combined process display, a pop-up window reveals the details of the vibration patterns in the process element. From here, a precise diagnosis can be made.
planned or impromptu – where the action is happening and where the diagnostic information is readily available. The best place is often right in the control room. Stora Enso is one company who recognized the value of this problem-solving collaboration when they set out to design the control room for the PM 12 production line at the Kvarnsveden, Sweden mill. This central meeting point is where mill employees of various job functions and suppliers can get together and look at the real-time data and solve current problems. The success of this concept relies on readily available information from the control room user interfaces – the operators’ windows on the process. The need for this purpose-designed meeting point is by no means unique to this mill. In fact, all mills should consider how meetings are arranged and how the data and diagnoses from automation systems could be – and should be – a central part of the solution process.

If the day comes when automation systems are smart enough to solve problems automatically, then mills may be on true autopilot. But the pulp and paper process and quality disruptions today must be solved by human interpretation and collective problem-solving skills. In this regard, the process insight and visualization available in today’s automation systems can be a major help.

References:
Valves

Reliable valves increase process efficiency and lower total costs

Admittedly, valves are not the most exciting components in the pulp and papermaking processes. Yet their role can be crucial in maximizing process availability and increasing efficiency – the much sought-after goals in today’s tough economic times. In the past 60 years, Metso’s flow control solutions have contributed to numerous success stories around the world.

TEXT: Marjaana Lehtinen

Cost efficiency is a term found on every pulp and paper mill’s top priority list now that the whole industry sector is going through a structural change with raw material and energy costs rising and environmental legislation tightening. To help pulp and papermakers tackle these challenges, Metso continuously develops its valve products and services further.

“With our flow control solutions, customers are able to maximize production efficiency, availability and process performance as well as reduce safety risks throughout the entire life cycle of their mills,” says Esko Ilmonen, Vice President, Flow Control, Pulp & Paper Sales and Marketing, Metso. “We offer professional customer service starting from valve selection and the first sales contact up to the mill run-time support, and assist in all valve-related issues and even beyond that.”

According to Ilmonen, Metso wants to be a true trailblazer, a technology leader, in valves. In fact, many valve innovations for the pulp and paper industry have originated at Metso, such as
Valves

the capping valve and the basis weight control valve. “Our challenge is to develop innovative products and improve existing ones to help our customers perform better and make more money. By understanding their drivers and challenges, we can be proactive in finding solutions in partnership with them.”

Ultramodern valve production facilities around the world ensure the known high Metso quality and value for money. An extensive global network of dedicated sales and service professionals help pulp and papermakers in their greenfield projects, rebuilds and modernizations as well as everyday operations.

Reliability lowers the total cost of ownership

During the past 60 years, Metso's valve solutions and related services have convinced global pulp and papermakers. This is shown by the fact that 75% of the world's pulp flows through Metso's valves.

This success is based on two factors intertwined with each other: experience and valve reliability. "We have extensive knowledge and experience of the pulp and paper processes and applications, and they have been built into our product offering," Ilmonen goes on. "The biggest innovation in the past few years has been the development of the market-leading valve controllers. They allow customers to better control and 'see' what is happening in the valve during operation."

Ilmonen also emphasizes the support given to customers after the startup of the mill. "With Metso's innovative valve controllers and professional global service teams, our customers are able to have online diagnostics of the valves, both in real time and as trends."

This allows the maintenance of each valve to be planned well ahead. Unplanned shutdowns due to valve failure can be avoided as well as maintenance of valves that do not need it yet. After all, nothing costs more than an unplanned shutdown in production. An important cost driver is also the maintenance frequency.

“The initial valve investment in a typical pulp or paper mill project represents only about 20–25% of the total cost of ownership throughout the valves’ lifetime. Therefore, it is essential to have a look at the operating costs of the installed valves as well,” Ilmonen continues.

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Pioneering products come from Metso

Metso's flow control product offering for the pulp and paper industry covers all the typical valves for control and on-off use, including segment, ball and butterfly valves under the Neles and Jamesbury brands. Additionally, there is a wide range of accessories, intelligent devices and software products, all engineered to meet each pulp or paper mill's needs and challenges. The products feature innovative, yet fundamentally simple construction, operation and maintenance features to optimize process performance at the lowest cost.

Innovation is a key driver in product development. It's no wonder that most of the pulp and paper industry-specific valve innovations come from Metso. They include the capping valve for batch cooking, high-consistency valve for bleaching, nelesACE™ valve for basis weight control, ceramic ball valve for erosive applications, and intelligent valve controllers, to name just a few. To date, Metso has delivered about 3,000 basis weight valves and more than 1,500 capping valves.

Since safety is an in-built feature, all valves meet even the newest safety (SIS/SIL) regulations.
Less variability saves the environment – and money

Operating according to the continuously tightening environmental laws and regulations is one of the many challenges at today’s pulp and paper mills. Metso’s valves and intelligent positioner solutions enable pulp and papermakers not only to improve their environmental performance but also to gain significant financial benefits.

For example, a pulp mill in Courtland, Alabama, USA, was able to reduce its carbon footprint by 160 tons just by improving the control performance of its processes. When an oversized valve was replaced with a better-suited Metso valve and an intelligent valve controller, process variability decreased, saving 0.43 tons of caustic every day and 150 tons annually. The increase in profit through savings in caustic consumption amounts to approximately USD 48,000 per year.

Ecoefficiency stands out
Metso’s flow control products are safe, durable and eco-efficient. They are manufactured with minimized use of raw materials and energy, and are designed to eliminate emissions.

So much more with intelligent diagnostics

To keep pace with – and actually one step ahead of – the industry’s needs, Metso’s technology know-how has expanded from reliable, high-quality valve solutions to a broad range of intelligent valve controllers and software solutions.

Intelligent valve controllers improve the control of industrial processes. They maximize the availability of valves and minimize the variability of control loops, in addition to increasing and maintaining mill safety. High availability and easy interpretation are the key success factors in effective data analysis.

Metso Valve Manager™ takes predictive control valve maintenance to a new level
One of the latest innovations is Metso Valve Manager™, representing 3rd generation diagnostics. It takes predictive control valve maintenance to a new level by making the available information more user friendly and more easily understandable. This, in turn, improves maintenance efficiency and process performance as well as brings significant cost savings.

Valve Manager is capable of processing the collected diagnostics information to visualize the condition of the valve in question with five different indices: control performance, valve condition, actuator condition, positioner condition and the condition of the operating environment. With this information, maintenance managers, engineers and process operators are capable of making educated decisions concerning the control valve maintenance without in-depth valve know-how.

Unexpected shutdowns can be avoided and the control valve performance can be maintained at an optimum level by continuously monitoring the condition of the installed base at the mill and by taking the necessary preventive actions based on the available diagnostics information. Also, with the help of the diagnostics, the available maintenance resources can be more efficiently allocated during shutdowns.

3rd generation soon also for on-off and ESD valves
Currently, Metso is developing its valve solutions further to bring these features available for the on-off and ESD valves as well. The technology benchmark devices on the on-off side, such as Metso’s SwitchGuard™ intelligent on-off valve controller, already include diagnostics features that are especially designed for on-off applications.
Valves

Some recent valve installations

**Paper and board mills:**
- UPM, Plattling Papier, Germany
- Stora Enso Kvarnsveden, Sweden
- Stora Enso Ostroleka BM, Poland
- Mondi Swecie, Poland
- Portucel Setubal PM 4, Portugal
- Shandong Chenming Paper, China
- Shandong Sun Paper, China
- Ningbo Asia P&P (APP), China
- Dongguang Lee & Man Paper, China
- ITC Paperboard and Specialty Papers, India
- Hunan Juntai Pulp&Paper, China
- Saica PM11, UK
- APP IKPP, Perawang, Indonesia

**Pulp mills:**
- UPM Fray Bentos, Uruguay
- Stora Enso Montes del Plata, Uruguay
- Suzano Maranhao, Brazil
- April Rizhao, China
- Fibria, Brazil
- Arauco Celulosa e Constitucion, Chile
- Sappi Ngodwana, South-Africa
- Mondi Syktyvkar, Russia
- Century Pulp&Paper, India
- Oji Nantong, China
- International Paper Bratsk, Russia

Performance that you can rely on

The fact that 75% of the world’s pulp flows through Metso’s valves clearly shows how much the global pulp and paper industry relies on their performance. The highest possible reliability is a good reason to place repeat orders – again and again.

However, sometimes quite a lot of time may lapse between repeat orders. One example comes from the Power Flute Savon Sellu Mill in Kuopio, Finland. When the mill was built in 1968, hundreds of Neles valves were installed in the processes. Although their environment has changed dramatically – they are now controlled digitally – some of the original valves still exist and work well. The installed base is currently being renewed slowly valve by valve. Only recently, the main steam valve in the board machine was changed to a new one after 36 years of successful operation.

“I appreciate Neles valves for their high quality and reliability. I sometimes refer to them as ‘install and forget’ valves. Neles valves are not the cheapest, but the savings are seen over time, as they do not need much maintenance,” says Rauno Nöjd, who used to work as the foreman in the instrument department.

Valves for almost all new mill projects

Where new pulp production capacity is being built, Metso is almost always involved in these projects. Have a look at some of our latest deliveries to pulp and paper mills around the world.

Good preparation for a major shutdown saves time and money

Every shutdown is a major investment of time and resources, but can be optimized using the latest tools and extensive maintenance expertise.

With three pulp mills in Chile, Empresas CMPC S.A. is the world’s fifth largest producer of pulp. Its Santa Fe Mill produces bleached eucalyptus pulp on two fiber lines. When preparing for a shutdown of fiberline 2 a few years ago, the mill entered into a predictive maintenance contract with Metso’s local service center for help in identifying which of the many valves needed service.

Altogether 74 control valves were identified as critical use, and Metso service personnel downloaded the performance data with the Metso FieldCare condition monitoring software three months before the shutdown. All the valves selected had been equipped with Neles ND9000 intelligent valve controllers when the line was built four years earlier.

“This predictive work helped to reduce the number of valves to be maintained and reduce the time invested by the planning personnel for this task,” says Javier Gonzalez, Electrical & Instrumentation Superintendent at CMPC Santa Fe.

Only 10% of the valves needed extensive work

Of the 74 valves, FieldCare showed that seven needed to be taken out for workshop maintenance and nine more required only minor servicing. Metso service personnel worked together with the mill to develop the list of spare parts needed for shutdown. This list helped to reduce the spare parts cost, previously purchased based on historical data.

As a comparison, on line 1 with older valve positioners, the mill’s maintenance department took out all 80 critical valves from the process because of the lack of accurate knowledge of their condition.

Metso’s predictive maintenance resulted in substantial savings on line 2 by eliminating unnecessary assembly and disassembly work and reducing the man-hours required during the shutdown. Javier Gonzalez continues, “It is necessary to add also the time and administrative work that was reduced related to spare parts purchases, due to the analysis and the improved delivery time of these items thanks to the service contract.”
One source for flow control and automation solutions

Dealing with Metso provides a pulp or papermaker with a clear advantage compared with other suppliers. In addition to flow control solutions, advanced automation technology also is available from the same source. The wide automation offering includes process automation systems, quality systems, information systems, condition monitoring, analyzers, camera systems and consistency measurements, among others.

This unique scope has attracted many customers around the world, such as the Mondi Syktyvkar mill, one of the largest paper producers in the Russian forest industry. In 2010, it completed the EUR 545 million STEP project, the most extensive mill upgrade in the Russian pulp and paper industry for the last three decades.

Metso was selected to be the supplier for the major part of the automation systems as well as to deliver over 1,400 control and automated on-off valves and almost 5,500 manual valves. The project involved new automation systems as well as replacing old systems and upgrades to existing Metso controls.

Main targets reached

Vladimir Moskokov, Deputy Discipline Manager E&I, Automation at Syktyvkar, says that the mill’s previous experience with Metso was important in selecting an automation supplier. “Metso systems are very friendly to engineers and programmers. All information is available and clear. The application tools for programming, troubleshooting and diagnostics are convenient and easy to use. With Metso DNA, we have a network of all automation and information activities, from field to office – strengthening teamwork and decision-making.”

The main targets of the project were to replace obsolete technologies, enhance mill safety, employ additional environmental measures and increase the quality and competitiveness of Mondi’s products. According to Denis Subbotin, Deputy Discipline Manager E&I, Instrumentation, the Metso valves play an important part in reaching these targets. “If we have good controllability, we save water and chemicals as well as achieving good quality in the paper.”

Expanding presence around the world

Besides providing an extensive product and service offering, Metso is also expanding its global presence. The target is to be closer to customers and support them in their daily work.

Metso has two highly modern valve technology centers for pulp- and paper-related products. The newest of them, located in the Greater Helsinki region, Finland, was inaugurated in September 2011. It employs about 800 automation professionals and has the best facilities in the world with regard to laboratory technology for testing valve performance.

The other valve technology center is located in Shanghai, China, and went on-stream in 2010. Both investments continue Metso’s strategy to strengthen valve operations globally. With the help of the new facilities, Metso will be able to concentrate on future flow control developments such as tackling fugitive emissions, and developing leakage reduction and low noise technology.

In 2012, Metso expanded its valve production facilities in Shrewsbury, Massachusetts, USA, acquired a globe valve technology and service company, Valstone Control Inc., in Chungju, South Korea, and established a new supply and service center in Vadodara, India. These are complemented by existing high-class industrial valve facilities in Sorocaba, Brazil, and Horgau, Germany.
The goals are clear – better results with lower costs. With Metso as your long term automation partner, you’ll see fast and ongoing improvements. Over a century of pulp and paper industry experience help us to clearly understand your objectives and challenges. Our intelligent approach, products and tools coupled with highly skilled service teams help you achieve and sustain results that make the biggest difference to your business profitability as a whole.

Discover more about Metso and automation services at www.metso.com/automationservices