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ÄÄNEKOSKI

A MILL FOR THE 21ST CENTURY



TECHNOLOGY LEADERS

FROM ROOT TO BRANCH TO FINAL FRUIT



Joachim Schönbeck, Member of the Executive Board, Capital Systems.



Humbert Köfler, Member of the Executive Board, Service & Units.

INNOVATIVE TECHNOLOGY IS KEY TO THE FUTURE OF THE INDUSTRY!

The year 2017 has been a remarkable, groundbreaking year for start-ups in the pulp and paper industry.

Two projects in particular stand out: Metsä Group's Äänekoski bioproduct mill in Finland, and Fibria's Horizonte-II, Três Lagoas mill in Brazil. Both developments are highly significant in their own right – Äänekoski with its forward-looking vision in terms of energy production and future bioproducts, and Três Lagoas with its status on becoming one of the largest pulp production sites in the world.

We at ANDRITZ are, of course, delighted and extremely proud that our leading technology and skilled personnel were instrumental in the success of those two enormous projects. But also, something new and different happened during those particular start-ups, something that will define how things are done in the future; for the very first time, our brand new *Customer Support Center*, located in Kotka, Finland was used for both projects to support commissioning, start-up, and troubleshooting through providing expertise in real time. Our experts at site can collaborate with our experts in the support center to ensure a smooth operation via a Decision Support Wall – which incorporates live video from the mill sites.

To fully back this up, we have a fabulous issue of SPECTRUM for you, with stories and reports from the front line of the industry, for instance: *The Self Driving Mill?* A story from Latin America on Eldorado, a mill that is virtually fully automated; a report on the aforementioned Äänekoski bioproduct mill, set to become a real jewel in the industry's crown; we have articles on exciting new innovations, as well as AR, using glasses for remote monitoring, and for the first time, we have a Round Table discussion report in the magazine where we invited some high-level industry experts from leading pulp and paper companies to discuss how they see the future of the industry.

A START-UP OF OUR OWN

And of course, we have another very significant start-up to tell you about, this time one of our own, the *PrimeLine TIAC*, ANDRITZ's very own Tissue Innovation and Application Center situated at our headquarters in Graz. The TIAC is the perfect symbol of our approach to innovation – listening to customers intently, anticipating what they might need next, and then ultimately accepting the challenge and moving forward together.

Enjoy SPECTRUM!

Sincerely,

Joachim Schönbeck

Humbert Köfler

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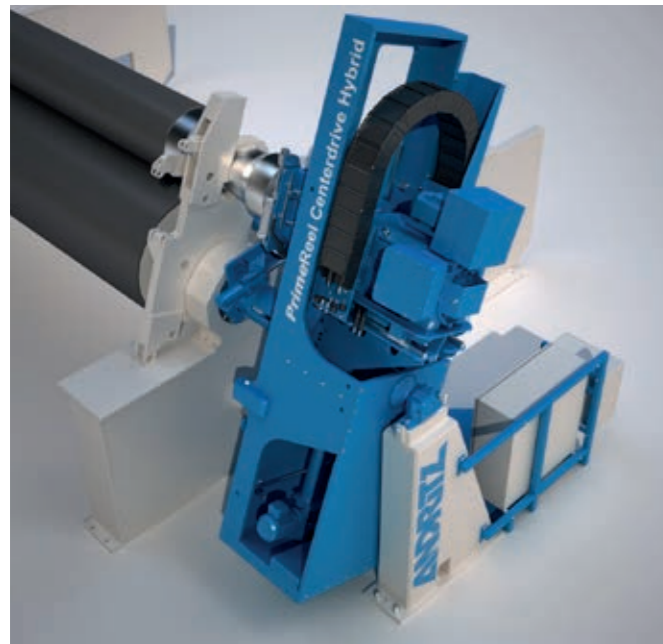
On the cover:

Äänekoski – A mill for the 21st century (page 20)

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NEWS



PrimeREEL CENTERDRIVE HYBRID –

A unique reeling system

The *PrimeReel Centerdrive Hybrid* from ANDRITZ turns a standard reel into a centerwind reel with absolute ease. The “plug and play” system follows the tambour from the primary into the secondary area, enabling constant, centredrive-assisted reeling during the whole process with only one drive unit. The *PrimeReel Centerdrive Hybrid* is perfectly suited to process large roll diameters – also with highly sensitive and smooth paper and board grades. Thus, it is no wonder that it has become the preferred choice not only for rebuild solutions but for challenging new reel installations as well.

Metsä Group wins **PPI AWARD**

ANDRITZ would like to congratulate Metsä Group on winning the top industry IoT award presented at a glittering gala ceremony held in Brussels, Belgium recently. The very first Pulp and Paper Industry Internet of Things Award, sponsored by ANDRITZ, was presented to Sanna Hämäläinen, Development Manager at Metsä Fibre's Joutseno Mill. The celebration dinner was held at the prestigious Royal Museums of Art and History, marking 25 years of CEPI's European Paper Week.

The Pulp and Paper Industry Internet of Things Award is a brand-new category introduced by industry information provider RISI, to highlight the intensive work being carried out by producers in the digitalization of the pulp and paper industry. RISI's PPI Awards are the only global awards honoring leadership, innovation, and strategic accomplishments within the industry.

ANDRITZ has been pleased to support Metsä Group in the ongoing digitalization of the Joutseno Mill in Finland, utilizing the very latest in Metris IoT technology.

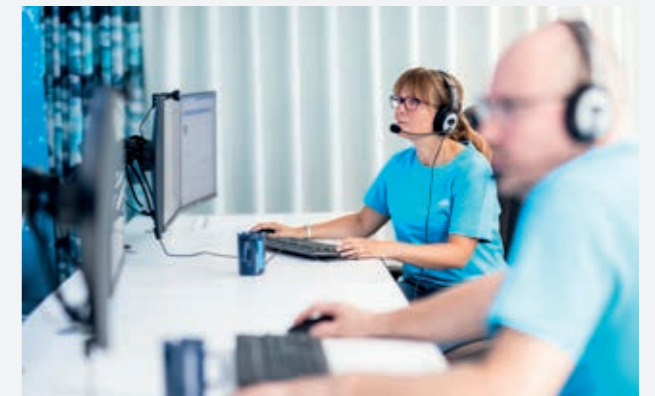
Watch our video covering the implementation of digital technology and data collection at the Joutseno mill here:

www.andritz.com/ppi-award-joutseno



The PPI IoT Award was presented to Sanna Hämäläinen (center), Development Manager at Metsä Fibre's Joutseno Mill by Harri Qvintus (right), Senior Vice President, Sales, ANDRITZ. The evening was hosted by former Miss Belgium, television presenter Anne de Baetzelier.

ANDRITZ OPENS REMOTE ONLINE CUSTOMER SUPPORT CENTER in Kotka



A new control room fitted out with the very latest in digital and IoT technology has opened in Kotka, Finland and is already making an impression across the pulp and paper world. The online Customer Support Center was utilized in two major pulp mill start-ups in recent months, Metsä Groups's Äänekoski bio-product mill in Finland and Fibria's second pulp production line at Três Lagoas in Brazil. Utilizing the center enabled mill operators and ANDRITZ experts on the ground to collaborate in real time via DCS screens with ANDRITZ experts based in Kotka during the crucial start-up phase.

The center at Kotka is connected in real time to customers wherever they are located in the world. The very latest in Metris

IoT tools from ANDRITZ, combined with video wall technology, enable 24/7 support from dedicated experts who view the operation in “read only mode”, allowing vital guidance to be given. The new center will be utilized for many different operations at mills, not just start-ups, including production ramp-ups, stabilizing production, and trouble-shooting of technical and process issues.

Jari Kapanen, Development Manager, Digitalization, says, “The Customer Support Center helps us to start-up mills faster than before and enables new start-up graphs. Additionally, we offer support to our customers around the clock to further enhance their processes across the pulp mill.”



ANDRITZ PAPERCHINE

key to expansion in North America

The acquisition of Paperchine helps ANDRITZ serve an important market with more technical offerings and better service. In turn, more papermakers have access to Paperchine's unique technologies through ANDRITZ's extensive global network.

ANDRITZ has become a leading supplier of paper machines in Europe – and tissue machines globally. Growth comes primarily from two areas: expansion of technical offerings and expansion into other geographic markets. Both of these growth strategies are in play in North America with the acquisition of Paperchine, a company devoted to paper machine engineering and services, as well as state-of-the-art components such as formers, dewatering elements, foils and blades, moisturizers, and starch spraying products.

"To be seriously regarded as a full-line supplier in the region of the world with the largest installed base of paper machines,

we needed to build up our technical and service organization, as well as provide local manufacturing," says Michael Pichler, ANDRITZ Senior Vice President and Division Manager for Pulp Drying & Paper. "With its strong position in North America (85% of its revenue comes from this region), Paperchine was on our short list of companies to approach."

The timing was opportune. AstenJohnson, Paperchine's owner, was receptive to a purchase offer from ANDRITZ, having honed its strategy to focus on core strengths – machine clothing, technical textiles, and non-

wovens. AstenJohnson was looking for a strong partner who would develop Paperchine further. ANDRITZ was a perfect fit.

The integration of Paperchine into ANDRITZ is well underway, according to the interim President of ANDRITZ Paperchine, Tim Ryan, who is leading the integration effort. "Things proceeded quickly from our initial discussions in November 2016 to moving forward as ANDRITZ Paperchine since July 1st of this year," Ryan says. "Part of the reason is that this is an ideal fit of complementary technologies executed at the right time."

MORE THAN A NEW BUSINESS CARD

What differences will Paperchine customers notice besides a new logo on the business card? "For our customers who use JohnsonFolios and VIB products, there will probably be little visible difference," says Jean-Marc Boudreau, Paperchine's Vice President of

Joe Mercado of ANDRITZ Paperchine grinds the edges of ceramic blades, which are used on forming tables, to a uniform smoothness at the Springfield, MA, USA workshop.



(Left to right): ANDRITZ Paperchine's Ben Conner, Applications Engineer; Dean Miller, Business Leader for Wet End Products; Jean-Marc Boudreau, VP of Field Sales and Marketing; and Tim Ryan, President look over a manually adjustable DeltaFoil unit prior to shipment to a customer.

Vaughn Wildfong, ANDRITZ Paperchine Senior Vice President (left), with Michael Pichler, ANDRITZ Senior Vice President and Division Manager for Pulp Drying & Paper, in front of an 11-headed moulding machine.



Field Sales and Marketing. "These components and consumables are products that ANDRITZ typically subcontracts when they supply a complete machine. These products are clearly complementary to their portfolio."

According to Paperchine's Senior Vice President, Vaughn Wildfong, the big difference will be seen in total solutions for rebuilds, conversions, and larger equipment packages. "Traditionally, Paperchine focused on the wet end of the machine," Dr. Wildfong says. "In a lot of cases, we could not offer one-stop solutions, due to our size. It was a stretch for us to manage larger projects with all the interfaces, procurement activities, logistics, etc. Now that we are part of ANDRITZ, a full-line supplier with top-notch internal systems for project management, as well as impressive financial strength – we can offer comprehensive packages and be very cost competitive."

ALL WET

Paperchine has excellent technologies in its current portfolio – including SigmaPro headboxes, JohnsonFoil dewatering ele-

ments, and VIB moisturizers – focused on the machine wet end.

The JohnsonFoil line includes drainage products (forming boards, foils, vacuum units, and ceramic or poly blades) and cleaning products (felt cleaning, showers, and mist-free systems). VIB systems include steam showers, spray dampeners, moisture profilers, and spray sizers.

Also in the forming area, Paperchine offers DeltaPlatform drainage systems that allow papermakers to optimize activity, shear, and drainage on the Fourdrinier table – saving fiber and optimizing formation. DeltaPlatform's customization capabilities, on-the-fly vacuuming, and adjustment of blade angles and height, can fine-tune formation to the exact needs of the papermaker for each grade. The latest versions of DeltaPlatform can be controlled by the operator's handheld wireless mobile touchpad.

MIND THE GAP

"Although our focus is North America," Dr. Wildfong says, "we also serve customers

globally. A good example is our horizontal PFGapFormers and PFTopFormers, which are patented technologies using our Pulse Frequency design concept. These technologies have the highest capacities available today, with wide operating windows, to provide the best sheet properties and efficiencies in the industry. We have customers around the world for these unique products."

The PFGapFormer is the latest shoe/blade gap forming technology, offering two powerful advantages: the sheet can be engineered toward low fiber orientation ratios to obtain high strength with fiber savings and a wide variety of grades can be produced since its drainage capacity can be easily adapted for various machine speed/basis weight combinations.

"To the uninitiated, gap forming can be considered to be more art than science," Dr. Wildfong says. "The fluid dynamics are more complex since it is a twin-wire process. But our installations around the world demonstrate that the capacity and quality is higher. Any existing gap former can be rebuilt to

a PFGapFormer, allowing reuse of existing frames and rolls. This makes it an ideal technology platform for grade conversions."

ENGINEERING, MECHANICAL, AND MAINTENANCE SERVICES

With its 180 employees in multiple locations in the USA, Canada, Germany, and Thailand, ANDRITZ Paperchine is well positioned to provide technical and mechanical services in support of paper machine maintenance and troubleshooting – as well as the technical auditing and design work required for machine rebuilds, conversions, or upgrades.

"There is a high demand for machine conversions to enable papermakers to produce different grades," Pichler says. "This requires intimate technical knowledge of the existing machinery to determine what is realistically possible after a conversion and to determine the return on investment. ANDRITZ Paperchine experts have this specialized knowledge, developed over a 50-year track record that began with the old Beloit company – and has evolved to

today. They will have an important role in developing and growing our business in North America and beyond."

ALREADY SELLING

"The consumable components from JohnsonFoil and systems from VIB are things that European customers have purchased for years and from which they can continue to profit," Pichler says. "We have already been selling Paperchine products in Europe just one month after the acquisition. This equipment is performing well and exceeding customer expectations."

It is the combination of ANDRITZ and Paperchine technologies that Pichler believes will be most interesting to papermakers. "By combining Paperchine technologies with our own shoe presses, drying solutions, calenders, and coaters – ANDRITZ Paperchine is now able to supply complete solutions in North America for new machines, rebuilds, and conversions. We are also exploring the synergies from each other's manufacturing facilities in Thailand and China," he says.

ANDRITZ PAPERCHINE MAIN PRODUCTS

- SigmaPro headboxes
- DeltaPlatform (adjustable Fourdrinier table)
- PFGapFormer (shoe/blade horizontal gap forming)
- PFTopFormer
- JohnsonFoil (ceramic/poly forming components and automatic valves)
- SpraySizer starch application
- VIB steamboxes and moisturizers

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TIAC

Opening up a world of possibilities in tissue



The tissue machine laboratory, which provides extensive testing methods, supports research and development efforts.



ANDRITZ has signaled its intent to become the global leader in tissue production technology with the opening of the Tissue Innovation and Application Center (*PrimeLineTIAC*), a dedicated tissue pilot plant for R&D in Graz. SPECTRUM – together with a customer – took up the invitation to visit the brand new facility.

The taxi driver drops us off at 8:00 am sharp outside the prestigious offices of ANDRITZ global headquarters on the outskirts of Graz, Austria. After identifying ourselves at the reception, we are quickly met by a very friendly and smiling Klaus Gissing, ANDRITZ's Vice President of Tissue, and the founder of the *PrimeLineTIAC* dream.

It must be said at this point that the ANDRITZ headquarters in Graz is not just the home to Members of the Board and all things corporate and financial, it is also home to some of the most precise engineering known in the global pulp and paper industry.

THROUGH THE TUNNEL INTO ANOTHER WORLD

After polite greetings, Gissing whisks us off through the tight security barriers and into the inner realms of ANDRITZ's office block. But there is no meeting room for us

here today. We are swiftly escorted past all the offices, led through a glass door and into a long pedestrian tunnel; it's as if we are going from one world into another – and we certainly are.

As we come out of the tunnel, blinking into the daylight of a large factory yard, wooden crates containing precision-made, heavy metal rolls and objects of all shapes and sizes are being stacked ready for transportation to destinations around the world.

And there, after a short walk along a well-marked path, and gleaming in the autumn sunlight, we have our first sight of the revolutionary *PrimeLineTIAC*, the solid, purpose-built base of trailblazing R&D for the global tissue industry. "This was our dream, which became a vision, and now here is the reality," says Gissing gesturing proudly.

ALL TISSUE STAKEHOLDERS WELCOME

And make no mistake, the *PrimeLineTIAC* concept is a revolution for the tissue industry. For the first time, all stakeholders are involved from across the board of the

tissue industry: producers, pulp suppliers, chemical companies, felt producers, converters – all are welcomed here to share in the development of the future of this dynamic tissue industry. In fact, ANDRITZ has already signed up 20 of some of the industry's most well-known names, for instance suppliers Albany, Danfoss, IBS, Nash, Solenis, as well as pulp production companies Södra and Fibria.

The partners in *PrimeLineTIAC* are given regular access to the pilot plant, and allowed to

carry out their own R&D alongside ANDRITZ experts in an effort to create the very best in technology and products in the areas of raw materials including pulp, chemicals, and consumables used in the production process.

"This exactly fulfills our idea," says Gissing. "A place where all stakeholders in the industry can come together, and work together on creating the future of the tissue industry."

Gissing then welcomes us into what looks like a brand new building, but which we are

told is an existing building ANDRITZ has restructured and totally refurbished for the purpose of *PrimeLineTIAC*.

As we enter the front door and turn left, there is a large downstairs office with a full picture window looking over the heart of the operation – the tissue machine. This is the control room, which is full of banks of computer screens and high-tech servers, and is the data capturing center where every conceivable production statistic will be recorded, gathered, and examined; and is set to what will become a major R&D hub for Metris, ANDRITZ's Digital IIoT Solutions. "Our Metris operations here will not only be a showcase for data capture and data management in tissue, but will also be the benchmark for Industrial IoT in the pulp and paper industry globally," explains Gissing.

CREATING THE FUTURE

We head up the stairs, past inspirational quotes on the walls, such as: "The best way to predict the future is to create it" and "Innovation distinguishes between a leader and a follower". All good motivational words for R&D people. Now it is time for our meeting and to find out more about *PrimeLineTIAC*,

A customer takes the tour with Klaus Gissing, ANDRITZ Vice President of Tissue (right) and Hannes Thier, ANDRITZ Project Manager *PrimeLineTIAC* (left).



Customers of *PrimeLineTIAC* can operate with absolute confidentiality when conducting trials at ANDRITZ's site in Graz.



"The *PrimeLineTIAC* will be the birthplace of new products and processes."

ANDREAS ANZEL
Director, *PrimeLine TIAC*



in the purpose built, light and airy, dedicated meeting room – also overlooking the tissue machine, this time from above.

"We began dreaming of an R&D center for tissue around 2003," says Gissing, "but we knew we needed to first establish a strong market position in order that such an investment would be accepted from our stakeholders."

"I took over as head of tissue at ANDRITZ in 2008, and by then we were stronger as

we had some success, particularly in China. After a lot of hard work and innovation, by 2015, we were being taken a lot more seriously, and after some deliberation, particularly about where the site should be – China or North America were initially on the table – we decided the best place was right here, in Graz, where we already have a lot of our R&D."

Graz is the ideal location for a number of reasons, not just because ANDRITZ headquarters is situated here. Gissing explains,

"This region of Austria is home to a number of large pulp and paper mills, including Sappi's flagship mill Gratkorn, Heinzl Group's Pöls and Laakirchen mills. It is also close to a number of leading pulp and paper universities, including one at Graz, and others not far away at Darmstadt in Germany and Grenoble in France.

"These seats of technical learning in the pulp and paper industry are going to be important for the R&D center; we will be working closely with them including a week

every year when they will have full use of the *PrimeLineTIAC* pilot plant."

PrimeLineTIAC has the added bonus that there is an ANDRITZ pulp R&D center within 200 meters of the site in Graz.

"WE BECAME OUR OWN CUSTOMER"

The concept of the *PrimeLineTIAC* took about 20 months to transform from vision to reality, with ANDRITZ encountering a number of challenges on the way – challenges usually reserved for its own customers. Hannes Thier, Project Manager, *PrimeLineTIAC*, says, "This was a unique situation as we became the supplier and customer in one – essentially we became our own customer.

"This allowed us to see projects from a different angle completely and experience what it's like to walk in our customer's shoes, for instance having to navigate through local council regulations on noise and emissions, something we are not normally included in. We learned a lot about what our customer has to go through with this project – and we will definitely apply this knowledge to future customer projects."

PEOPLE AND TECHNICAL KNOW-HOW AT THE CENTER

At the fundamental center of *PrimeLineTIAC* is knowledge and experience. These two vital ingredients are provided by people with unheralded experience in innovation in tissue globally. ANDRITZ, as well as having its own experts, has gone out of its way to look for the best in the industry – among one of those hired is Thomas Scherb, a tissue industry innovation professional who has 17 years' experience operating tissue pilot plants. Scherb is now Sales Director at *PrimeLineTIAC*. Gissing says, "You can have all the technology in place, but it is the knowledge of people that really makes a difference when it comes to innovation. We were delighted to welcome Thomas Scherb on board in August 2015, who has been instrumental in bringing the *PrimeLineTIAC* to life. He has brought with him real hands-on experience of running a tissue pilot plant in Brazil for a number of years."

Scherb will work closely with Andreas Anzel, ANDRITZ's own tissue R&D head who has over 13 years' experience on the front line of tissue innovation, and is now Director of *PrimeLineTIAC*. The combination of Anzel and Scherb's many years of experience on the front line of tissue development brings

unique expertise and synergies that allow the center to thrive when it comes to tackling new ideas and innovations.

The center also has a supremely well qualified operations team headed by Boris Jancic, who brings with him vast experience of commercial tissue production in Eastern Europe.

INTO THE HEART OF THE OPERATION

After a detailed technical briefing given by Gissing and Thier in the customer meeting room (see GETTING TECHNICAL section), we were ushered downstairs to the ground floor to view the heart of the operation at *PrimeLineTIAC*, the brand new tissue machine sitting in all its innovation-ready glory at the base of the building.

The tissue machine has been built taking into account all the parameters and demands a modern, future-looking tissue producer could possibly think of. The machine will allow up to eight different configurations that can be set up to test numerous energy saving ideas, raw material, and new product trials. Added to which there are in the region of 3,000 sensor points around the machine, which will record and save every



"You can have all the technology in place, but it is the knowledge of people that really makes a difference when it comes to innovation."

KLAUS GISSING
Vice President of Tissue



GETTING TECHNICAL

conceivable piece of information or data that will later help to analyze the results of any R&D experiments carried out.

Gissing says that any data gathered on trials and product runs at *PrimeLineTIAC* are all treated with the utmost confidentiality, and all results, reports, and samples are the customers' property to take away with them. ANDRITZ cannot see any data unless the stakeholder is sharing the results with them.

READY FOR ANYTHING

"We have been avidly listening to what our customers are saying with the building of this tissue plant," concludes Gissing. "We know that energy savings are high on their list of priorities, but we also know that raw material usage in the form of pulp and chemicals is also as important. And, of course, we are acutely aware that improvement in quality is paramount for customers as they seek to capture new markets and increase their own market share for their existing products.

"R&D on all these crucial aspects is all in a day's work for *PrimeLineTIAC*."

After around three hours, our tour of the *PrimeLineTIAC* came to an end and we were taken back through the tunnel and past the security of the ANDRITZ headquarters. As we left the building we at SPECTRUM could only conclude that the finished *PrimeLineTIAC* – already being massively well received by the tissue industry – is an R&D center that is totally equipped for any ideas a customer, supplier, or university professor could ever want to throw at it.

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STOCK PREPARATION

All types of pulp – softwood, hardwood, virgin fibers, recycled fibers, bagasse, bamboo, and straw – can be treated in a continuous production line from pulping to the tissue machine headbox and without intermediate long storage that might negatively influence fiber properties. The system is split into separate short and long fiber lines to allow best development of fibers depending on any possible furnish. The different fibers are pulped in the FibreSolve FSV pulper, which allows high slushing consistencies up to 7.5 percent. Then fibers can be deflaked and refined in the Papillon refiner CS, where they are treated in the cylindrical refining zone much more gently. The layout features a flexible system configuration – interconnecting piping between the lines enable the use of the refiner and deflaker for short as well as for long fiber. It is then possible to evaluate the impact of different fiber treatment on the final product.

The individual stock components are then mixed in two ANDRITZ ShortFlow blending systems. The approach-flow system follows – two ModuScreens HBE, which combine lowest energy requirements with minimum pulsations and perfectly protect the tissue machine. Excess water from the tissue machine is clarified in a micro flotation system and used partly as shower water. There are also two MicraScreens with a fine-slotted screen plate and automatic self-cleaning device. The sludge with a consistency of approximately 2 percent, is dewatered in the Reject Compactor ReCo-L, which is able to thicken from low consistencies up to a dryness suitable for disposal.



THE TISSUE MACHINE

The new tissue machine can be operated in eight different configurations, from conventional tissue on a CrescentFormer with suction press or the new *PrimePress XT Evo* shoe press, to conventional enhanced tissue (vertical CrescentFormer), textured and premium structured produced on TAD and VTAD configurations. An overview of the tissue machine:

- Design speed: 2,500 m/min
- Headbox: 1-, 2-, 3-layer configuration with dilution control
- Former: CrescentFormer, TwinWire former
- Pre-Dryer: Two TAD drums, 14 ft
- Hood: TAD hood
- Press: Suction press, shoe press
- Dryer: Steel Yankee, 16 ft
- Hood: High-temperature hood
- Sheet run: Passive/active foils
- Reel: Centerwind reel



AUTOMATION

The eight configurations on the tissue machine are supported fully by a *PrimeControl E* automation system that allows flexibility by supporting several functional areas: Enhanced operability and maintenance, Embedded drive and quality control system, and Eco monitoring (resource management system). These three focused "E" areas are enabled by a set of integrated functionalities that lead to proper results tailored to the specific needs applied. The configuration can be controlled by mobile device (such as smartphone or tablet), in the main control room, or by remote control. The ensemble of the functional bundles is an extremely modern control system for tissue plants; it also supports in reconfiguration and pre-production phases, as well as during the whole operation phase. Additionally, the very latest digital technology available at ANDRITZ for monitoring and maintenance purposes is in use, including Metris Augmented Reality Glasses that allow operators to monitor equipment in real time.



PUMPS

The *PrimeLineTIAC* has been equipped with high-quality, multi-functional ANDRITZ process pumps. They fulfill three different purposes within the production process: transportation of all liquids, operation in the stock preparation process, and drainage. The core pump, however, is an ANDRITZ headbox pump with the lowest pulsation, which is achieved by offset rotor blades developed especially for tissue production. With efficiencies beyond 90 percent, it helps to save valuable energy, and conveys stock suspensions with consistencies of up to 2 percent.

Each of these pumps is equipped with a sensor concept that is unique in pilot plants worldwide. It allows the facility not only to control the operating mode of the pumps, but also to obtain important information on the process and on operation under different conditions.

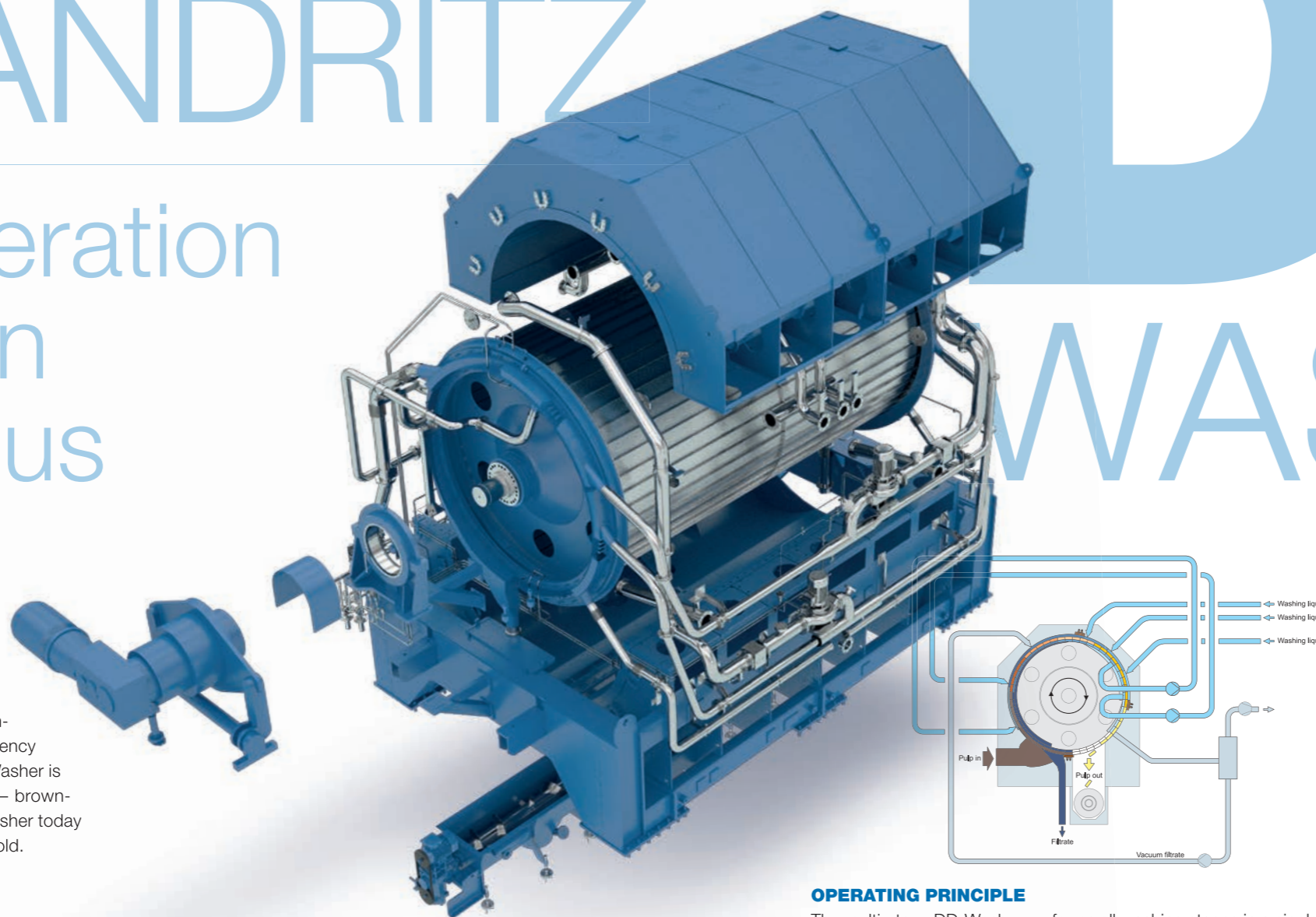


EVOLUTION OF THE ANDRITZ DD-WASHER

Each generation better than the previous

The DD-Washer was introduced in the early 1980s when the first commercial-scale unit went into production in a kraft pulp mill in Finland. Today, five generations later, every kraft pulp mill in Finland has ordered at least one DD-Washer (the latest order is for Stora Enso's Kemi mill) – and the washer has achieved global acceptance. With more than 340 installations in 24 countries, the multi-stage washing efficiency and extremely high production throughput of the DD-Washer is clearly preferred for all fiberline washing applications – brown-stock, post-oxygen, and bleaching. The largest DD-Washer today has almost 150 times the capacity of the first washer sold.

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BENEFITS:

- Multiple washing stages on a single drum
- Compact design
- Extremely high washing efficiency
- Extremely energy efficient
- Fractionated filtrates to conserve water
- Retains fiber qualities: less fiber damage when no mechanical pressing
- Fast start-up and high availability
- Production throughput up to 6,250 t/d in a single unit

OPERATING PRINCIPLE

The multi-stage DD-Washer performs all washing stages in a single rotating drum and roughly at the same consistency without dilution. The housing around the multi-stage drum is divided into various washing zones. Pulp slurry at low (3-6%) or medium (8-10%) consistencies is pumped into the feed zone, where it is dewatered to form a porous pulp cake. The washing is done via displacement (i.e., the wash water displaces the cooking liquor or bleaching chemicals in the pulp). A key design feature of the DD is that at each washing stage, the pulp is washed counter-currently with the filtrate that has been fractionated from the succeeding stage. This lowers overall water consumption and results in more complete displacement.

CLEAR ADVANTAGES OF DISPLACEMENT WASHING

In the early days, almost all mills had vacuum drum filter washers. The main disadvantage was the amount of serial equipment to reach a certain wash result and a limited process temperature. Following this, wash presses were introduced. The main disadvantage

was the requirement to dilute and then mechanically press the pulp several times to reach a desired high consistency. The DD-Washer performs all washing stages in a single rotating drum and roughly at the same consistency without dilution. Since there is no mechanical pressing during washing, the DD-Washer is extremely gentle, retaining all the bulk, stiffness, and strength of the original fibers.

OPTIMIZING THE CAKE HEIGHT

Much of the work in the fifth generation DD-Washer was focused on optimizing the height of the pulp cake to achieve improved drainage and efficient displacement washing. For drainage, the thinner the pulp cake the better. However, if the cake is too thin, the advantages of displacement washing technology are lost. Fifth generation DD-Washers are tuned to produce a cake of 35-40 mm in brownstock applications and 40-50 mm in bleaching installations, depending on process conditions. This boosts throughput while maintaining high washing efficiency.

"The design of the DD-Washer has been perfected through evolution, not revolution. The newest generation features improvements in pulp and filtrate hydraulics to increase throughput by about 20%."

PASI IMMONEN
 Manager Washers and Filters
 ANDRITZ Fiber Technologies



ÄÄNEKOSKI

A Mill for the 21st Century

Metsä Group's Äänekoski bioproduct mill has been the talk of the global pulp and paper industry for some time now with its outstanding environmental efficiencies and ambitions for new products derived from wood. Starting up in August 2017, ANDRITZ supplied crucial technology to help make the bioproduct mill a showcase production site for the 21st century.



The environmental and sustainability statistics coming from Metsä Group's new bioproduct mill at Äänekoski in Finland are truly impressive: the mill will produce 1.3 million tonnes of pulp a year from 6.5 million cubic meters of wood with zero use of fossil fuels at the same time as using only 10 m³ of water per tonne of pulp.

Timo Merikallio, Project Director, has been leading the charge at Äänekoski as the 1.2 BEUR project went from planning to fruition at start-up on August 15, 2017. Merikallio says, "The decision to call Äänekoski a "bioproduct mill" was almost a natural occurrence. At the outset of this project, we started looking at a wider scope and looking deeply into what other products could be made, in addition to, of course, our leading bioproduct, which is pulp.

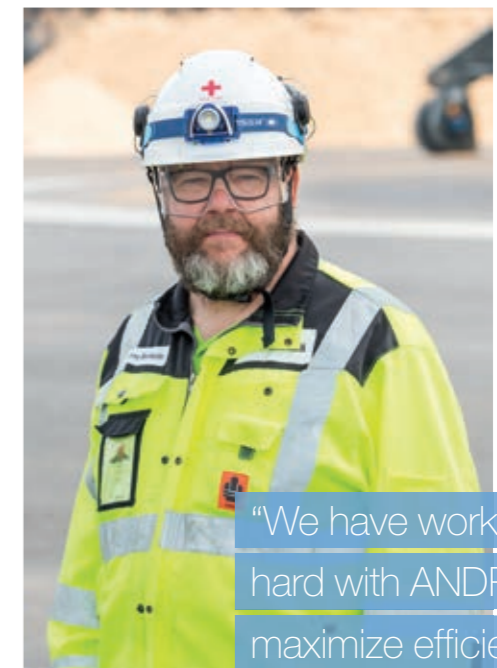
"But this was not just about other products; we also wanted the mill to become a leader when it comes to environmental performance, a target which we are proud to have achieved. We have worked hard with ANDRITZ – as with all suppliers to this project – to maximize efficiency and reduce or reuse side streams in every area of the mill."

ANDRITZ was chosen to supply major, critical technology at the mill to ensure that the Metsä Group's sustainability and environmental demands were met across the board. The order included the very latest, world-class technology for the woodyard, fiberline, evaporation plant, and recausticizing plant. The core equipment supplied by ANDRITZ originated largely from Finland - domestic content was nearly 80% - and thus had a significant positive employment impact on ANDRITZ's engineering staff located in Kotka, Lahti, and Varkaus as well as on the ANDRITZ workshop in Savonlinna where a big part of the core equipment was fabricated.





Aerial view of the Äänekoski mill.



“We have worked hard with ANDRITZ to maximize efficiency and reduce side streams in every area of the mill.”

TIMO MERIKALLIO
Project Director,
Bioproduct mill project

MAXIMUM ENERGY EFFICIENCY – RIGHT ACROSS THE MILL

Metsä Group was adamant that it wanted the very best and most efficient equipment when it came to energy savings for this mill. Johan Engström, Chief Technology Officer, ANDRITZ PULP & PAPER, says, “A major source of revenue for the bioproduct mill is bioenergy production, so any energy saved in the process means extra revenue directly onto the bottom line.

“We accepted this challenge and looked very closely at every area where energy savings could be made; for instance, for the first time, we integrated a separate evaporator unit – Digester Evaporator (DeVap) – into the fiberline. This makes a big difference to energy efficiency, as 100% of the direct steam to the digester top is replaced by secondary vapor from the DeVap. The DeVap increases dry solid content of the black liquor and therefore less evaporation capacity is needed in the evaporation plant.”

ANDRITZ also installed a new type of bark press – the HQ-Press – which increases the dry solid content of the bark. Engström says, “What the new, highly efficient bark press does, mechanically saves a lot of energy in the subsequent processes.”

ANDRITZ latest technology for water management is also implemented into the mill, which has resulted in emission reductions but also increased energy savings. Engström adds, “To deal with emissions, it makes sense to reuse the condensates and filtrates we already have in the loop. This not only minimizes the emission problems, but is also great for energy savings as there is no fresh water that needs to be heated up.”

The woodyard order consisted of a complete wood processing plant with three debarking and chipping lines, chip handling systems with three stacker reclaimer-type chip piles, and complete bark handling and storage. Each debarking line processes both hardwood and softwood and is designed for world record capacities using pine, spruce, or birch.

The softwood and hardwood fiberline comprises a TurboFeed chip feeding system, a two-vessel Lo-Solids cooking plant and brownstock and bleaching plant based on DD-Washers. The softwood capacity of the line is the highest in the world at 3,900 tonnes per day.

ANDRITZ delivery included the world's most energy-efficient black liquor evaporation

plant. The evaporation plant has the highest capacity in Europe, at 1,650 tonnes per hour and is one of the world's largest single line recausticizing plants with a white liquor production of 16,000 m³ per day.

LIKE AN OPEN BOOK

For the first time, the Open Book project management method was used during the mill development stage. ANDRITZ Project Director for the bioproduct mill, Mika Mäkelä says, “We received the order from Metsä Group in April 2015 and it was a major order for us – in addition to the complete woodyard, the recausticizing plant, fiberline, and evaporation plant as core orders, defined scope came as part of the Open Book concept.”

Open Book is a project management method in which the target price of the specified part of the “standard” equipment is agreed between supplier and customer. The purchasing preparations are made in open cooperation with the customer, taking advantage of all the know-how that participants have. Mäkelä explains how it works in practice, “The Open Book orders are placed in the customer's name. Afterwards, when the plant is started up, the actual Open Book costs are checked and compared with the target price. If savings

were made during the project, they are split between the supplier and the customer, and any cost overruns are divided up in a similar way. So, the risk and opportunity are divided between supplier and customer. The Open Book management went extremely well in cooperation with a very professional and experienced customer in Metsä Group.”

Merikallio says, “The Open Book concept for this project was great from the very beginning – it alleviates the risk to both the customer and supplier, but it also means you get the best resources at the best price.”

The project was organized according to ANDRITZ's proven global management system, whereby a detailed organizational structure is developed for multi-divisional operations such as the bioproduct mill. “The objective with our global management system is to ensure that all those involved know who is responsible for what, where, and when,” says Mäkelä.

One of the factors that Mäkelä was impressed with during the project, was the collaboration with the customer, which was very smooth and efficient. He says, “The

Metsä Group has a very professional approach, with experienced teams put together from several of its mills.

“Another factor that must be emphasized is the importance of the well-planned, logistical program as the project commenced. It was a really tight space that we were working on at the the bioproduct mill site and the just-in-time scheduling of deliveries and erection worked really well.”



ANDRITZ supplied the Decision Support Wall (DSW) at the woodyard control room, which aids operators and maintenance groups in their daily work. It also acts as a common online remote meeting place for ANDRITZ and the operators.



One of the special features of the fiberline and evaporation plant connection is a new evaporation system for liquor extraction, digester evaporator DeVap, which enables the evaporation process to start first at the cooking plant.

THE VERY LATEST IN INDUSTRIAL IOT AND VISUAL TECHNOLOGY

The mill started up on August 15, seven minutes before schedule, and is using the very latest technology for monitoring and managing the whole mill process. Merikallio says, "This is a huge plant; as an example, the woodyard consists of three debarking lines and three chip piles, and we are using the best available technology for the overall management of the production."

"The start-up went pretty much as planned and now we are operating right on the start-up curve. We are running both softwood and hardwood here – we tend to run softwood for five days, and then switch over to hardwood for two days so, as you can imagine, there is quite a lot of optimization to manage with two types of wood and three debarking lines."

The central heart of the mill operation is conducted from an ultramodern mission control room with vast banks of large video screens and monitors, showing almost every part of the mill operation.

"We monitor all operations from our central control room where we have five or six experts looking at all areas of the mill's production," says Camilla Wikström, Mill Manager at the bioproduct mill. "And for the first time, when we are doing our daily checks around the mill, we are using an iPad to check on individual pieces of equipment, for instance, pumps, checking on performance, and making sure everything is running to optimum levels. If there is a problem, we can pretty much get instant feedback and get a correction plan immediately into action."

For the first time during a major start-up, ANDRITZ brought in extra skills and knowledge in real time remotely via its recently opened Customer Support Center, located in Kotka, Finland. Engström says, "The Customer Support Center is a key new addition for us to assist our customers throughout the world. The remote access showing the actual DCS screens enables real-time support and helps the communication between people on site and our experts in Finland."

"This means both mill personnel and ANDRITZ engineers can collaborate with experts based in the center while looking at exactly the same information from the mill operation on screen via the DSW. Essentially, it is as efficient as our experts being at the mill operation itself."

One of the IoT solutions ANDRITZ has supplied to the bioproduct mill is the Decision Support Wall (DSW) for the woodyard control room, which aids operators and maintenance groups in their daily work.

The DSW comprises live videos from processes and equipment, data recording facilities, and equipment diagnostics such as ChipperEKG and CrusherEKG.

ANDRITZ will also be introducing an advanced alarm triggering and process diagnostics display with a Traffic Light system

where process status is indicated with colors that are controlled by ANDRITZ Metris tool rule base. "The Traffic Light system is an excellent new addition to help monitor and maintain the efficient running of the woodyard," says Engström. "Obviously when a green light is being displayed on the system, all is running well. However, when a yellow light appears, it means the operator needs to do something, for example, when monitoring the condition of knives in the chipper."

"Essentially, the Traffic Light system alerts an operator to a problem before it becomes a major issue and, therefore, gives the opportunity for early action to take place. It is an excellent tool to assist in preventative maintenance."



"I am quite sure we will see a lot more innovation in bioproducts around the bioproduct mill in the future."

CAMILLA WIKSTRÖM
Mill Manager, Bioproduct mill

One of the new, key technologies introduced to the woodyard is the new generation bark press, ANDRITZ HQ-Press, which targets to deliver around 5%-unit higher dry solids content of bark than any other press on the market.



"The Open Book management went extremely well in cooperation with a very professional and experienced customer in Metsä Group."

MIKA MÄKELÄ
ANDRITZ Project Director for the bioproduct mill



GETTING TECHNICAL



(L to R): Mika Mäkelä, ANDRITZ Project Director for the bioproduct mill; Camilla Wikström, Mill Manager; and Timo Merikallio, Project Director from the bioproduct mill.

PAYING OFF, WITH BENEFITS

The hard work that has gone into the technology and equipment has paid off with benefits all around; as well as the 240% electricity self-sufficiency, the mill is well on its way to dramatically reducing effluent flows. Merikallio says, “There will be a lot of ongoing work to maximize all efficiency and streams around the mill. For instance, a normal pulp mill effluent flow is around 20 m³ per tonne; we have managed to squeeze that down to 10 m³ per tonne. Those types of improvements will continue mill-wide in all processes in the future.”

“We are proud to say that the Äänekoski mill is using the same environmental permit that was granted for the original mill it replaced – even though the mill is two and a half times bigger,” adds Wikström.

Metsä Group is also encouraging other bioproduct companies to join the mill, forming a cluster of biotechnology expertise that can make use of the side streams, as well as take advantage of the on-site energy and water management facilities. Wikström concludes, “EcoEnergy SF Oy is using our sludge as a raw material to make biogas for use as fuel for cars, as well as solid fuels that are produced in the form of pellets. I am quite sure we will see a lot more innovation in bioproducts around the Äänekoski mill in the future.”

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THE WOODYARD



ANDRITZ supplied the Äänekoski bioproduct mill with three debarking and chipping lines, three stacker reclaiming chip storage piles, and bark handling. Each debarking line can process both softwood and hardwood and is designed for world record capacities – pine/spruce/birch respectively at 470/350/270 m³ solid-over-bark per hour. Each debarking line also included a de-icing conveyor, a debarking drum, and the world’s biggest horizontally fed HHQ-Chipper. Chip quality out of the chippers is so high that instead of the normal chip screening system there is only scalping screen provided for the chips before they enter the fiberline.

One of the new, key technologies introduced to the woodyard is the new generation bark press, ANDRITZ HQ-Press, which targets to deliver around 5%-unit higher dry solids content of bark than any other press on the market. This has increased the green net energy of the bark by around 15%. ANDRITZ supplied four such HQ-Presses to Äänekoski.

The chip handling system consists of three stacker-reclaimer piles with volume of 120,000 m³ each, ensuring good homogenization of chips with first-in-first out (FIFO) principle towards the fiberline.

The next steps in the area of high-tech IoT implementation will include live process video streams from helmet cameras feeding back to the video walls and Augmented Reality through smart glass applications, which will assist further in maintenance and service activities and in technical discussions.

THE SOFTWOOD AND HARDWOOD SWING FIBERLINE



The softwood and hardwood fiberline comprises a TurboFeed chip feeding system and a two-vessel Lo-Solids cooking plant with a new advanced heat energy recovery system based on an evaporator unit connected to liquor extraction of the digester. Pulp washing at the brownstock and bleaching area is based on DD-Washers, which enables extremely low effluent flow at the mill. With the highest softwood capacity in the world at 3,900 tonnes per day, ANDRITZ has doubled the capacity of its previously delivered highest softwood fiberline; hardwood capacity is 4,500 tonnes per day.

EVAPORATION PLANT



The ANDRITZ evaporation plant at Äänekoski is the world’s most energy efficient with the highest capacity in Europe (1,650 t/h) and is closely connected to the fiberline using the latest ANDRITZ solutions. The plant has seven stages that concentrate black liquor to very high dry solids content – around 85%, allowing for ultra-efficient combustion in the recovery boiler. One of the special features of this key department at Äänekoski is the digester evaporator, DeVap, which enables the evaporation process to start already at the cooking plant.

RECAUSTICIZING PLANT



The white liquor production capacity of 16,000 m³ per day makes the ANDRITZ recausticizing plant at Äänekoski the largest in Europe, as well as one of the world’s largest single-line plants. The plant has two LimeFree centrifuges for dregs, slaker-classifier, renewed LimeWhite white liquor disc filter, and LimeDry lime mud disc filter.

A new key technology introduced to the white liquor plant is the ANDRITZ LimeWhite. With its renewed mechanical concept, it gives benefits in increased capacity, higher reliability and savings in operation.

REMOTE ONLINE SUPPORT



For the woodyard, fiberline, evaporation plant, and recausticizing plant areas at Äänekoski, ANDRITZ provided online support through its Metris tools for the mill start-up. Using video wall technology, 24/7 support is given with nominated process resources from ANDRITZ’s office in Kotka, Finland.

Declaration of INDEPENDENCE

Indian packaging and paperboard giant, ITC Paperboard & Specialty Papers, is well on its way to achieving the challenging ambition of becoming 100% self-sufficient in local wood and fiber supply for its Bhadrachalam Mill in the state of Telangana, Southern India. ANDRITZ's vast mechanical pulping knowledge, along with the latest proven technology, are instrumental in the company achieving its aim.

Southern India is an immensely fertile area where a variety of food staples and cash crops profusely grow including cotton, chillies, and rice, providing millions of people with food and tens of thousands of farmers with vital livelihoods. It is also the perfect region and climate for fast growing

eucalyptus, and therefore ideal for providing ITC's flagship mill with fiber for its integrated, high-quality packaging operation.

ITC launched the highly ambitious plan to use domestic fiber some time ago – mainly to alleviate the reliance on what

is a constantly volatile pulp market, but also to bring much needed extra forms of revenue to the local farmers. CEO of ITC's Paperboards & Packaging Division, Sanjay Singh, says, "Over a number of years we have been working on a plan with local farmers within a 200 km radius of the Bhadrachalam mill. We have been working hard at our plantation clonal research center, developing exactly the type of eucalyptus that we need firstly – which will make good pulp for our products but also will be an attractive longer-term crop for the farmers to grow."

Around 15,000 farmers now supply the mill with wood for its pulping operations, growing eucalyptus in rows around existing crops, which means as well as a regular income from crops such as cotton and chillies, they can now also have a longer-term investment from the trees.

"Our hard work has paid off, and we are now virtually self-sufficient in local fiber at the mill."

SANJAY SINGH
CEO of ITC's Paperboards & Packaging Division



"The quality of the wood is very important," continues Singh. "To achieve optimum quality, the wood needs to grow for the longest possible period, and we have to convince the farmers about this. So, for example, if they left the wood in the ground for five or six years, they would earn a lot more money because of the yield, say compared to three years. Our hard work on this front has paid off, and we are now virtually self-sufficient in local fiber at the mill."

TOP QUALITY FIBER NEEDS TOP QUALITY PULPING TECHNOLOGY

After all the work that has gone into making sure there is enough high-quality fiber for its production needs, the next step for ITC was to find the very best in technology for its mechanical pulping operation. This was going to be a challenging task, as ITC had some extremely demanding parameters when it came to quality, efficiency, and environmental performance.

The new pulping operation would have a design capacity of 300 admt/d and, most importantly for ITC, the line had to work with a zero-effluent concept. The final pulp should have a very low Chemical Oxygen

Demand (COD), as a lot of its products are used for food packaging (note: COD, is a measure for dissolved detrimental substances present in pulp and effluents of a mill). ITC also wanted to utilize synergies with other processes on site in an effort to ensure sustainability and to keep raw material consumption and running costs to a minimum. For instance, BCTMP effluent is sent to the mill's integrated kraft mill where it is evaporated together with the kraft mill black liquor and clean condensate is sent back to the BCTMP plant where it is used for pulp washing. This not only keeps the mill effluent low but also reduces consump-

tion of fresh water, which is a welcome plus in the Telangana state. Furthermore, chemicals from the BCTMP effluent are recovered in the mill's recovery boiler and recausticizing plant and oxidized white liquor can be used as an alkali source in the mechanical pulp mill.

K Nagahari, Divisional Head – Projects, ITC Paperboards & Specialty Papers Division, says, "We took a long time searching for exactly the right technology that would suit our operation at Bhadrachalam. We travelled around, particularly in China, where we looked at various suppliers'

Refining is the heart of each mechanical pulping process.



Conveyor feeding chips into the mill.



Row of ANDRITZ Screw Presses for the washing stage.

mechanical pulping references, but after careful and thorough examination, we decided that ANDRITZ BCTMP technology would suit us best – mainly because of its vast experience and flexibility of its processes.”

Added to the reference visits, ITC and ANDRITZ set up pilot plant trials in 2015 at ANDRITZ’s facility in Springfield, USA. Nagahari says, “In 2015, we carried out extensive trials with eucalyptus wood species at the Springfield pilot plant, and the results we achieved there gave us even more confidence.”

ANDRITZ first presented its BCTMP concept to ITC in 2010, with reference visits in China the following year. In 2014, ITC was able to experience first-hand, again in China, ANDRITZ’s patented, very latest technology in BCTMP, Pre-conditioning Refiner Chemical Alkaline Peroxide Mechanical Pulping (P-RC APMP) technology.

Thomas Paar, ANDRITZ Pulping & Fiber Division, says, “The new P-RC APMP pulping line is the ideal technology for ITC’s raw material and products. The P-RC APMP process is ultimately designed for optimum pulp properties, such as brightness, strength, and bulk. The process impresses with minimum chemical, energy, and water consumption for all hardwood species.

The P-RC APMP system incorporates the long-term experience of ANDRITZ in mechanical pulping technology combined with its tradition as machine manufacturer and

contract partner for the pulp and paper industry. The dedication of ANDRITZ to the constant development of process technologies and equipment is reflected by the fact that nowadays ANDRITZ has a major worldwide market share in supplies to the pulp and paper industry.”

NEW TECHNOLOGY FOR INDIA

From contract signing to start-up it took around 14 months, with the actual start-up of ITC’s P-RC APMP line taking place in March 2017. Markarand Barhanpurkar, Unit Head, Bhadrachalam, says: “The start-up of the BCTMP line has seen a real boost in morale at the mill, mainly because it is a first for an Indian company to install this new type

of technology. In fact, the whole process was new to us, so we have needed a lot of support from ANDRITZ engineers who bent over backwards to provide everything that we needed.

“Of course, as in every project, there have been teething problems, but together we have solved those, and we believe the preliminary learning curve has passed. As our operators’ confidence has grown in the whole process, ANDRITZ has stepped back a little, but we know they are always there if we need any extra expertise.”

The project to install the P-RC APMP technology at the Bhadrachalam mill represents

“In 2015, we carried out extensive trials with variable eucalyptus wood species at the Springfield pilot plant, and the results we achieved there gave us even more confidence.”

K NAGAHARI
Divisional Head – Projects,
ITC Paperboards & Specialty
Papers Division



ITC Bhadrachalam mill operation team and ANDRITZ sales team from left to right: Kunisetty Rambabu - Chief Manager - Pulp Mill; AV Hari Krishna, Manager - Pulp Mill & BCTMP; KD Sharma, General Manager - Pulp Mill; Thomas Paar, ANDRITZ; A. Shiva Prasad, General Manager Projects; Rao Narayana, ANDRITZ

a first for India – there are very few mechanical pulping operations in the country. For ANDRITZ, the installation is the latest in a long line of P-RC APMP lines, with over 35 systems operating worldwide.

THE BOTTOM LINE

Vadiraj Kulkarni, Chief Operating Officer, ITC Paperboards & Specialty Papers Division says of the difference the new mechanical pulping line is making, “We are delighted to be the first company in India to have invested in the P-RC APMP line. It goes perfectly with our strategy of promoting plantations in India and helping farmers to enhance their earnings, which is, of course, good for them.

“Most importantly, the project has allowed us to reduce our dependency on foreign imports of chips and market BCTMP, which has been very high in the past, and we are delighted that this technology and expertise has led us into this enviable position so quickly. Yes, making mechanical pulp has its own challenges, but we are pleased to have such a strong technical team behind us in ANDRITZ, and we believe we will soon be the leaders in this field.”

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“The whole process was new to us, so we have needed a lot of support from ANDRITZ engineers who bent over backwards to provide everything that we needed.”



MARKARAND BARHANPURKAR
Unit Head, Bhadrachalam

GETTING TECHNICAL

Getting technical on the next page.



GETTING TECHNICAL

THE BCTMP SCOPE AT ITC

The project scope at ITC covers the complete process line from chip washing to storage tower and is perfectly suited to the mill's demands of flexible production of high-quality pulps at the most economic operating costs.

The advanced and patented P-RC APMP (Pre-conditioning Refiner Chemical Alkaline Peroxide Mechanical Pulping) technology applies chemicals (oxidized white liquor, sodium hydroxide (NaOH), and hydrogen peroxide (H₂O₂)) in impregnation and after the primary refiner. The 2-stage MC-HC bleaching system is located right after the primary refiner, but before secondary refining and screening. A washing stage was added before the first bleaching tower to remove detrimental substances and ensure optimum bleaching results and minimum peroxide consumption.

At ITC, the process is designed as a single line starting with chip washing followed by chemical impregnation with the unique ANDRITZ MSD Impressafiner. The MSD Impressafiner compresses the chips and thus removes dirty liquor from the chips and opens up the chip structure before the chemicals are applied in the impregnation stage. In particular, with the local eucalyptus woods with its high extractives contents and high dryness, this is an important step before refining and bleaching to reach high brightness and keep the chemical consumption low.

Refining is the heart of each mechanical pulping process. At ITC, it is designed as a single line, 2-stage refining process with an ANDRITZ HC refiner in the first stage and a single-

stage ANDRITZ TwinFlo LC refiner as the second stage. There is also an ANDRITZ TwinFlo refiner installed for reject refining.

The low-consistency pressure screening system consists of proven ANDRITZ ModuScreens with highest screening efficiencies to remove shives and undeveloped fibers. In addition, a cleaner system is installed to remove dirt particles and so-called stone cells (or "scleroids"). In order to reduce COD and other dissolved substances in the final pulp to a minimum level and also

keep the amount of wash water and effluent as low as possible, six counter-current washing stages with ANDRITZ Screw Presses are included. Thus, the Bhadrachalam mill sets a world record for any the lowest COD in final pulp.

After the MC storage towers, the pulp is sent directly to the mill's three paper machines where it is used for the production of different paper board grades.

The BCTMP effluent is sent to the mill's integrated kraft mill, where it is evaporated, burned, and chemicals are recovered. On the other hand, clean condensate and oxidized white liquor are sent from the kraft mill to the BCTMP plant.

The project also includes an ANDRITZ Heat Recovery System to treat the process steam coming from the HC refiner to produce clean steam that is then used in the effluent evaporation system.



Gerhard Schiefer
Head of ANDRITZ AUTOMATION



Metris Augmented Reality Glasses

Foresee digitally – enhanced potential for interactive operation and maintenance

The very latest technology innovations at ANDRITZ provide the pulp and paper industry with specifically enhanced potential for interactive operation and maintenance where and when it is needed most. With the implementation of ultramodern devices such as augmented reality glasses, hidden potential can be utilized and overall equipment effectiveness can be improved significantly.

Imagine being responsible for mill maintenance and operation in a demanding modern mill environment, with tough targets on quality, productivity, and sustainability. Augmented reality is a high-tech way of engaging staff, enabling them to monitor and improve on all those challenges using the AR glasses that are connected to the main control system of the plant. Depending on individually selected features, a wide variety of useful tools can be utilized to carry out crucial alterations and adjustments in less time, with less cost, and with employees fully focused on the task in hand.

The following features are already available in this next generation of digital assistance:

- **Documentation** – Related material and documentation can be examined quickly and directly at the machine. Operators can access any information needed such as circuit diagrams and operating manuals.

- **Equipment Identification** – In order to make the most relevant information accessible directly where it is needed, equipment is identified in the whole mill. Virtual signs and identification are placed directly on the equipment concerned.

- **Live Values** – Real-time information on the device can be accessed at the tap of a finger. Real process information and live values can be checked at once, indicating proper functioning of machines and processes.

- **Checklist** – In case of malfunctions, operators are assisted with digital checklists in order to resolve the issue without delay.

- **3D Remote Support** – Interactive video conferencing functions simplify the maintenance process, making it extremely efficient. Dedicated remote support service teams can not only see the environment view of the operator but can use 3D annotation within the view in order to guide the operator towards solutions of each individual issue.

- **Online Spare Part Catalog** – A plugin to the ANDRITZ Online Spare Part Catalog enables direct placements of parts to go into the shopping cart, which will be handled immediately by ANDRITZ for submission of sales quotations.

- **3D Simulation** – Digital features such as 3D animations are a bonus when providing assistance and training. Futuristic hologram models of maintenance pro-



cesses placed in the operator's line of vision just above the real equipment enhance the training effect and acceptance by the operator, while also shortening any downtime needed.

- **Work Archiving** – In case of several shifts, operators can record and save videos of important steps of procedure for their co-workers or for knowledge management.

With its new digital technologies such as the Metris Augmented Reality Glasses, ANDRITZ is taking mill operations to the next level. By monitoring an intuitive human-machine interface of the control system that is equipped with groundbreaking digital and visual technology, highly efficient workflows make the future calculable and enable proactive action through the analysis of data. Benefits such as optimized performance and cost-efficiency are achieved with ultramodern digital IIoT solutions.

METRIS FOX

ONLINE QUALITY INDEX FOR PULP

Up until relatively recently, bonding and fiber strength when producing pulp could only be measured in a laboratory, which means time, expense, and delayed results, as often the pulp is already made when the tests are being carried out. ANDRITZ's Fiber Online Index has changed all that and provides a tool for real-time monitoring of pulp quality.

"This was a real problem for us originally," says Ismo Nousiainen, CEO (as of January 2018), Metsä Fibre,

"Pulp samples were sent to a laboratory and we would only see the results around a week later. It was often the case that our customers had already used the pulp by the time we had the results.

"The driver for the development of the quality index was the lack of online measurement for pulp refining properties. We were getting online measurements for brightness, fiber length, and dark spots on our lines, but at the time refining properties were based on samples for the laboratory. We wanted to develop an online quality index that correlates refining results and gives customers information about our pulp performance in their processes."

To solve the problem, Metsä Fibre developed a quality online index of its own in 2012. The new tool was so good that it was recognized in 2014 when the index won a quality award in Finland. Subsequently, the measuring technology and calculation method Metsä

Fibre developed has now been acquired by ANDRITZ and rolled out under the brand Metris FOX (Fiber Online Index), which it continues to develop further.

HOW DOES METRIS FOX WORK?

Metris FOX works by collecting data from the mill's production information system (PIM). Every 10-minute slot of production is followed through the production stages. Jari Kapanen, ANDRITZ Development Manager, Digitalization, explains further, "For each 10-minute slot of production, a "basket" program collects variables that are affecting yield and other quality parameters. In each production stage, a Metris FOX user can have an estimation of final product quality and can see how different process variables will affect final quality.

"These calculations are continued through the pulp mill fiberline from the digester to the drying machine. After that, all historical data of final quality forecasts are stored."

"We wanted to develop an online quality index that correlates refining results and gives customers information about our pulp performance in their processes."

ISMO NOUSIAINEN
CEO (as of January 2018), Metsä Fibre



Metris FOX follows all the main process variables – there are 17 of them altogether that affect yield and quality parameters, for instance, alkali dosage during the cooking process, temperature in the O₂-stage or peroxide dosage in the bleach plant. "It was a big challenge to equalize all the 17 parameters," says Harri Qvintus – Senior Vice President Sales, ANDRITZ.

ANDRITZ will offer a specially designed window for operator use, where the user can follow the forecast of the final quality and value of each parameter. Kapanen says, "The operator can see in each different process stage what the final quality forecast is and identify the process parameters that might be out of the setpoint or operating range. Adjustments can then be made to improve final quality."

THE FINAL PROOF

Metris FOX is currently being run at two pulp mills in Finland, including Metsä Fibre's Äänekoski bioproduct mill. Nousiainen says, "The results come in improved product quality. The quality of the final pulp can be followed in the fiberline and can be controlled to enable maximum quality output. Another feature is the ability to provide the customer with full quality information so they can fine tune their processes to enable maximum efficiency."

Qvintus concludes, "The FOX index is also beneficial for integrated mills. When properties of incoming pulp are known, no refining tests are needed. It has been proved that the FOX index is beneficial for all types of paper machines: fine paper, LWC, board, and tissue. One final customer has declared that after seeing the FOX index, she knows exactly how to adjust her paper machine to operate it in the most economical and optimized production."



A photograph of George Reynolds, an Account Manager at ANDRITZ, sitting in the driver's seat of a car. He is wearing a green baseball cap with the Portland Timbers logo and a green jacket with white stripes on the sleeves. He is looking towards the camera with a slight smile. The background shows a blurred view of trees and a building through the car window.

A WEEK IN THE LIFE OF

... GEORGE REYNOLDS

Workplace: ANDRITZ, North America
Profession: Account Manager

After starting out in the fiberglass industry in 1984, George Reynolds joined ANDRITZ North America in 2005 as an Account Manager specifically focusing on stock preparation and recycled fiber mill customers on the West Coast.

Reynolds was born and raised in Vancouver, Washington, and has always lived in the city. Married to Lynn, they have two daughters and three grandchildren. A lifelong soccer enthusiast, Reynolds manages an adult team in his hometown and is an active supporter of his local team, The Portland Timbers.

ANDRITZ has a large operation in North America and Canada with revenues of around 1 billion USD and employing some 2,500 people. Working out of about 40 locations, ANDRITZ North America provides dedicated sales, service, research laboratories, and manufacturing services covering Pulp and Paper, but also other business areas including Metals, Hydro, and Separation.

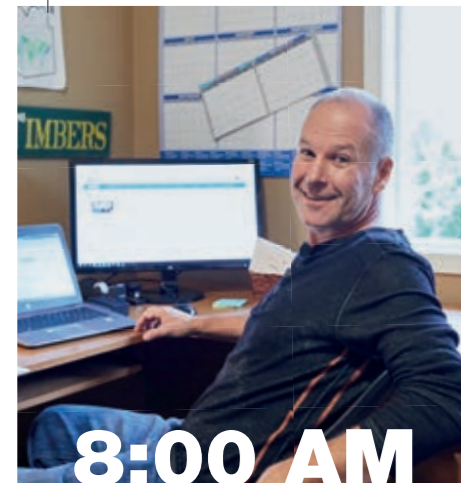
ANDRITZ North America gave permission to the SPECTRUM editorial team to share a WEEK IN THE LIFE of George Reynolds in November 2017.

WEEK 45 / 2017 NOVEMBER 06 -11



MONDAY 06 NOVEMBER

For Reynolds, Monday morning is dedicated to planning the week ahead. This morning, customer calls are made to important contacts at Kimberly-Clark, Novipax and Georgia-Pacific. One of the calls Reynolds makes turns into immediate action, as a critical part for a shaker screen has broken and needs urgent replacement. Reynolds resolves the issue quickly, calmly, and successfully.



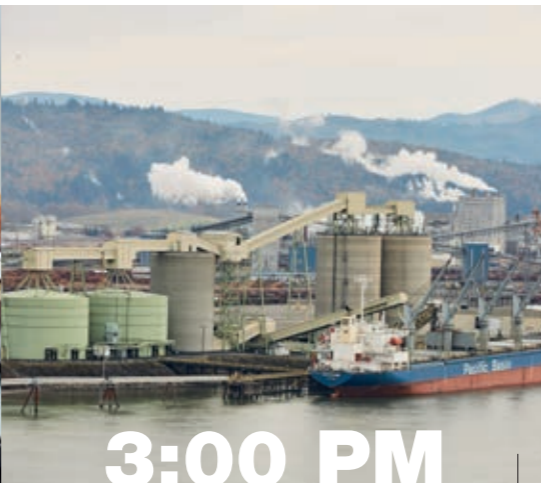
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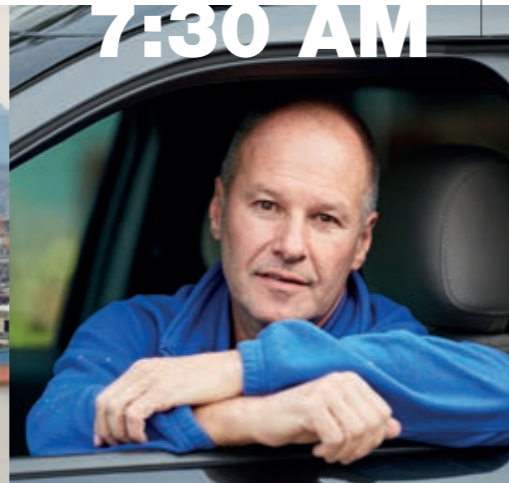
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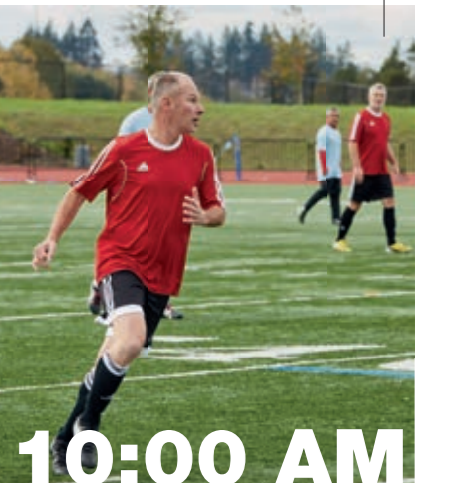
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MONDAY 06 NOVEMBER

Continuing in preparation for the week ahead, it's time to gather up the safety gear and get the car ready for the busy week of traveling up and down the West Coast visiting pulp and paper mills to help them with their challenges.

TUESDAY 07 NOVEMBER

Reynolds visits several pulp and paper companies regularly in Longview, Washington, USA. One of them is North Pacific Paper Corporation (NORPAC). Here he meets Nick Bush, Maintenance & Engineering Manager at the mill where discussions take place regarding a potential refining project. Meetings also take place at the mill with the thermo-mechanical pulping (TMP) team to talk about refining and screening.

TUESDAY 07 NOVEMBER

Heading back home to Vancouver, just in time to take a clear day snapshot of the mill. Reynolds has a special affinity with NORPAC – he has been associated with the mill in one way or another since its construction in 1978.

The rest of the day is spent writing reports on the customer visit to NORPAC as well as setting the wheels in motion with other ANDRITZ people on topics discussed at the mill. It is also time to pack for a mill visit road trip for the rest of the week!



ANSWER GEORGE'S QUESTION
& win a hat and a scarf of his favorite soccer team!



WEDNESDAY 08 NOVEMBER

On the road! The next few days will be extremely busy, as Reynolds conducts a tour of some of his most important customers on the West Coast. Mill visits on this agenda will be to an undisclosed site in southwest Washington, WestRock and Caraustar, Tacoma, and Cosmo Specialty Fibers, Cosmopolis.

WEDNESDAY 08 NOVEMBER

First stop is an undisclosed location in southwest Washington, where the mill has a maintenance outage. This is a busy time, as several maintenance jobs need to be completed while the mill is down, so even finding a parking space at the site is an ordeal!

Reynold's task here is to inspect the condition and maintain the stock prep cleaners. The Deculator internals will be inspected with a paper machine superintendent. But before anything else, Reynolds sits down with the ANDRITZ crew at the mill to work out a Safe Work Plan. This is a crucial part of any activities at mills on Reynolds' patch.

The inspection work carried out here today is to make sure that parts are repaired or replaced, and that the equipment is in optimum condition when the mill starts up again.

THURSDAY 09 NOVEMBER

The day starts at 7:30 am with calls to the ANDRITZ teams about customer orders, followed by a confidential visit by Reynolds to WestRock Tacoma Mill (the SPECTRUM team was not allowed into the mill on this occasion). While Reynolds was at the mill, SPECTRUM caught up with Paul Kanoke, Operations Maintenance Coordinator, of WestRock who talked about his experience working with Reynolds. He says: "I met George around 2008 and we have done a lot of work together to make machines run better, for instance, optimizing refiners. We have had a lot of successes in making paper machines run for longer and improving uptime."

THURSDAY 09 NOVEMBER

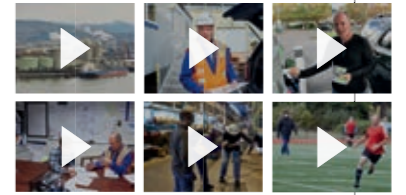
Next mill on the agenda is Caraustar, Tacoma, to talk to Mark Lindstrom, Mill Manager, about current projects and future proposals for the mill. Lindstrom says of Reynolds: "I've known George for 10 years now; he has been very receptive, and always puts us in touch with the right people at ANDRITZ when we have particular challenges or demands. He is also great for new ideas, and a different approach to looking at things."

FRIDAY 10 NOVEMBER

After an extra early start with a customer phone call at 6:30 am, Reynolds arrives at Cosmo Specialty Fibers in Cosmopolis for a meeting with Greg Dineen, Machine Superintendent and Kevin Eldred, Machine/Finishing Process Engineer. The discussions revolved around capacity bottlenecks and possible energy savings projects. The mill produces dissolving pulp.

FRIDAY 10 NOVEMBER

Inspection of the Minton Dryer and Bauer Cleaner at Cosmo Specialty Fibers with Dineen (right) and Eldred (left), before heading home for the weekend.



View video footage of this report online:

www.andritz.com/witlo-reynolds



SATURDAY 11 NOVEMBER

And now after a typically busy week, it's the weekend, and time for soccer! Reynolds is the team manager for his football team, Fat Tuesdays FC, who play every weekend in a 50+ league. Unfortunately, on the day SPECTRUM watched a match, Fat Tuesdays FC were beaten by arch rivals, New Kings, by two goals to nil.

Metris cloud engineering

SAVES TIME AND MONEY

Montes del Plata uses an integrated Cloud-based engineering tool from ANDRITZ AUTOMATION to stay instantly up to date.

The Montes del Plata mill in Uruguay is the first to license the Uniform ANDRITZ Tool (UAT) as a platform for its own use – for efficient collaboration not only with ANDRITZ, but also within the mill and with sub-suppliers. Montes del Plata is jointly owned by Stora Enso and Arauco.

The UAT is an integrated database developed by ANDRITZ over the years as its central engineering tool for process, instrumentation, electrical, and automation projects. The core software (Siemens COMOS) was launched in 2002, but has been highly customized for the unique requirements of the pulp and paper industry by ANDRITZ over the last 15 years.

PERFECT COMPLEMENT TO IIOT

From the beginning, the UAT was prepared as a Cloud in the ANDRITZ environment. Distributed databases on four continents with Citrix® server farms have enabled Cloud engineering within the ANDRITZ GROUP for many years, according to Alexander Rostek, Manager of Detail Engineering and Tools for ANDRITZ AUTOMATION. “We built this tool to streamline the flow of information and to ensure consistent quality from

process engineering directly into detail engineering and automation design,” Rostek says. “To date, we have handled more than 6,500 projects with this platform.”

The platform provides a perfect interface within Metris – the company’s brand for digital Industrial Internet of Things (IIoT) solutions. Metris enables customers to benefit from mobile functionality, remote maintenance solutions, real-time data, and mill optimization using Metris OPP (Optimization of Process Performance) software.

“We rely on this Cloud-based platform to collaborate with customers, engineering partners, and other sub-suppliers working on a project anywhere in the world,” Rostek explains. “It provides benefits not only during the engineering phase, but through the entire lifecycle of a project. Because of this, we decided to make this database available to customers – and Montes del Plata seemed like a perfect first partner giving secured access to the respective project within UAT.”

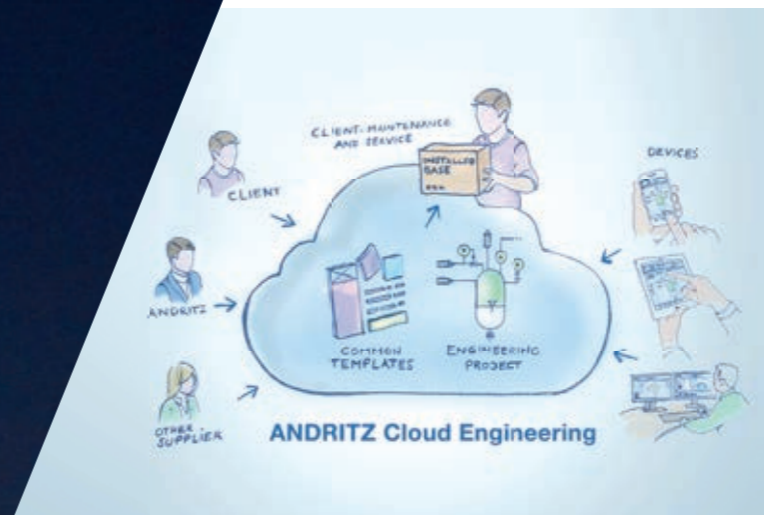
One of the reasons for the fit with Montes del Plata is that ANDRITZ was the main technology supplier for the entire mill, which started

up in 2014. ANDRITZ delivered the production equipment for the woodyard, fiberline, pulp drying plant, chemical recovery island, and power island.

“Our engineering experience and knowledge as a manufacturer of equipment for Montes del Plata is embedded in this database,” Rostek says. “Since Montes del Plata was using several different tools for engineering and design that were not seamlessly integrated, we believed they would benefit greatly from having our proven engineering environment as a foundation for their future work.”

“We were very interested when we were first approached about licensing the Uniform ANDRITZ Tool,” says Jose Vazquez, Superintendent of Engineering and Maintenance at Montes del Plata. “The design for this mill was fully implemented by ANDRITZ in this software, so there is a lot of information already in place. And, having everything on the same software platform was very appealing.”

According to Federico Ferreira, Electrical Engineer at Montes del Plata and the person managing



the implementation of the software in his company, a key advantage is that everyone involved in a project is now working with the same data. “It was a much slower process before when we worked with lists in one software, engineering drawings in another, and other documents in a third software,”

Ferreira says. “When we made a change in one document, we used to have to remember which other documents to change. Now, the COMOS software does this automatically.”

INSTANTLY UPDATED

A key advantage to the UAT is that all engineering data is maintained in a single database, which helps improve engineering quality. The seamless transition from basic to detail engineering simplifies documentation and revision management. Common templates for lists, P&IDs, loop diagrams, and other documents are included. The software has automatic updating procedures so that any revision or update is instantly reflected in all relevant documents – and this revision is made instantly available to everyone.

“It is important that everyone is working with the same data,” says Pedro Casagrande, an Electrical, Automation, and Instrumentation Analyst with ANDRITZ, who has been working in a support role with the Montes del Plata team. “In the old way of working, it was possible that a change was made in the field – say an instrument was added or a pump was relocated – and this change never made its way to the drawings. You find out eventually, but a lot of time and frustra-

tion is involved in getting the correct information. Because all data is always available and up to date, it depicts the actual as-built status of a mill at all times.”

UP TO SPEED

It took a reasonable amount of time for the Montes del Plata users to learn the COMOS software and get up to speed. Now they are quite proficient and use it daily, according to Casagrande. “My one regret,” Vazquez admits, “is that we didn’t start using this software from the start-up of the mill. We have about 1,000 documents and P&IDs in backlog that we are putting in the system to make it completely current.”

ANDRITZ continues to update the database for capital projects in which it is involved at the mill: capacity increases in the fiberline, recovery boiler, and the addition of an automated pulp baling line. Montes del Plata can see and review this engineering information in real time. “More importantly for us,”

Ferreira says, “are the smaller projects that we undertake on a regular basis without ANDRITZ. We now use this as a common tool with our sub-suppliers.”

As an example, the mill recently added a sump pump in the white liquor plant. “Even something as simple as a pump addition requires engineering – modifications to the cabling, wiring, logic, level control, and P&IDs,” Ferreira explains.

The software is based on objects. Components are described graphically. Data associated with the component is combined to form a single object in the database. All related data sheets, lists, and other documents are linked to the corresponding objects. Anyone with the proper security clearance involved in engineering and operations has access to the same data for a given object.

“This made the engineering for the new pump easy,” Ferreira says. “We created the new objects and data tags in one day – and the revisions automatically flowed through the related documents in the database. This was work that used to take us three to four days. The time savings were significant.”

“Metris Cloud Engineering will be our principal platform in the future,” Vazquez says. “All modifications will be up to date. This lays the foundation for greater reliability in decision-making and more efficient work throughout the entire mill – saving us time and money.”

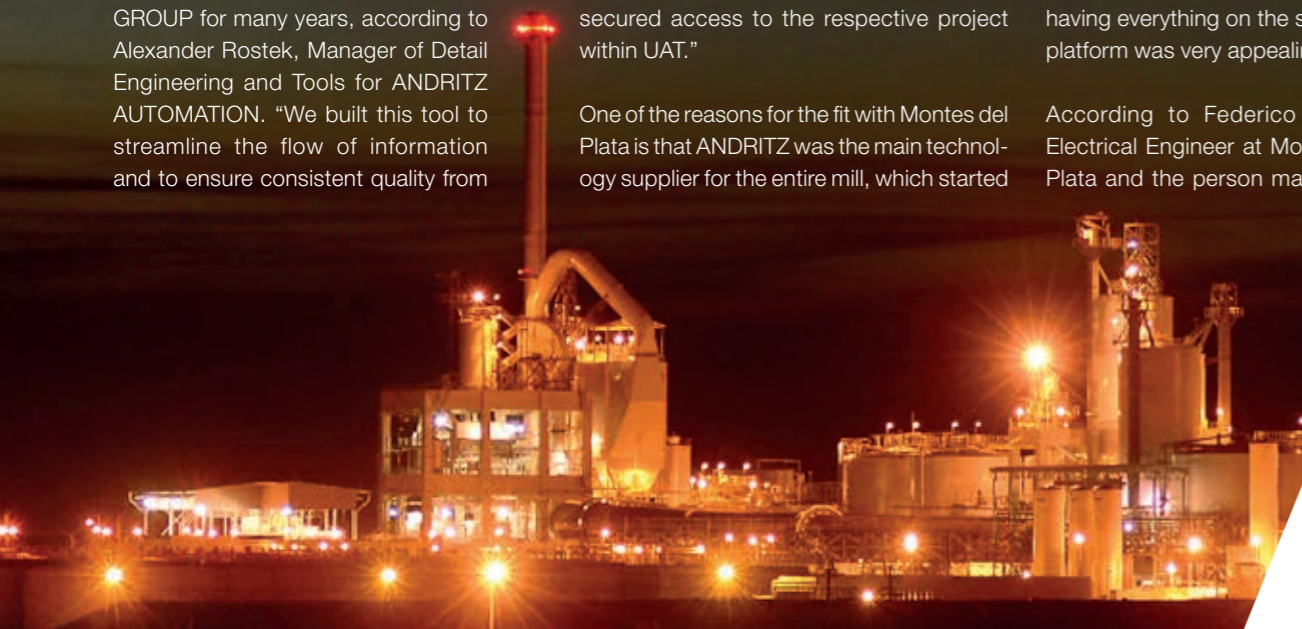
CONTACT

Alexander Rostek
alexander.rostek@andritz.com



“Our engineering experience and knowledge as a manufacturer of equipment for Montes del Plata is embedded in this database.”

ALEXANDER ROSTEK
Manager of Detail Engineering and
Tools for ANDRITZ AUTOMATION



THE SPECTRUM ROUND TABLE
Getting to the heart of industry matters



FORWARD THINKING

The Future-Proofing of the Pulp and Paper Industries

SPECTRUM recently brought together industry professionals from three of the leading companies in the global industry, Metsä Group, Smurfit Kappa and UPM, to discuss the main issues affecting the industry. Below are excerpts from a lively and enthusiastic discussion held at ANDRITZ offices in Vienna.

The basic definition of future-proofing is the ability of any one given entity to continue to be of value into the distant future, ensuring that the item does not become obsolete. In the case of pulp and paper mills, this becomes even more complicated, as there are numerous working, moving, and operating components that need to be taken into account.

FROM THE INDUSTRY:

Ismo Nousiainen – CEO (as of January 2018), Metsä Fibre
Mat Maessen – Head of Paper Production Technology, Smurfit Kappa Group
Sami Saarela – Vice President, Finland Operations, UPM Pulp

FROM ANDRITZ:

Bjorn Hansen – Vice President, Commercial Sales, ANDRITZ
Harri Quintus – Senior Vice President, Sales, ANDRITZ

MODERATOR:

Mark Rushton – Editorial Consultant, SPECTRUM Magazine

What do our panelists believe about the long-term future for the pulp and paper industries and how are their companies strategizing for the future?

SAMI SAARELA: At UPM, we strongly believe there is a need to replace non-renewable materials with renewable ones such as wood and wood fiber. We believe there is a growing demand for pulp and we would like to share in that growth. We also believe that pulp is a good business which will yield enough profit in the long term to enable us to develop other products from wood, which will make us even more profitable. Our strategy is to be committed to growth and to the development of new products.

ISMO NOUSIAIMEN: At Metsä Group, we face the global megatrends head-on that are impacting on consumption. We work on solutions directly associated with these megatrends: for instance, climate change, population growth, and aging populations. In the case of climate change, for instance, we are examining all our processes and products – looking at ways to replace those made from fossil fuels, in packaging for example. And in our processes we are completely eliminating the use of fossil fuels – as in our latest start-up, our Äänekoski bioproduct mill. Of course, we are also actively looking to make other products out of wood.

MAT MAESSEN: At Smurfit Kappa, our slogan is “Open the Future” and that slogan is based on our firm conviction that for the long-term future wood, paper, and fiber based materials are really the way to go, as they play a central role in the future of this world. We have strong beliefs in recycling, but also in virgin wood, and we have a firm strategy to replace fossil fuel derived products wherever we can. In fact, we have an internal slogan as well,

“Sustainability in Every Fiber” and these two slogans really do sum up our ongoing strategy at Smurfit Kappa.

BJORN HANSEN: From the ANDRITZ point of view, where our customers go, we follow. But of course in some ways we have to be ahead; we have to look forward to our customers' customers and analyze the trends. In our case, our slogan is: “We accept the challenge!”, but to do that we have to be in close cooperation with our customers, so really, we approach these challenges together.

HARRI QUINTUS: A must for us at ANDRITZ is effective research and development alongside our customers. Although some of them have been really demanding, keeping on track with them has enabled us to grow and develop some excellent products and processes.

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Looking ahead into the future, what are the main challenges our panelists are facing?

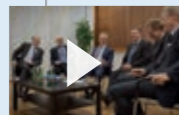
MAT MAESSEN: Our challenge is keeping to the idea of the circular economy – we must use raw materials in such a way that there is no waste, low water consumption, and minimal emissions, and to reuse everything we possibly can. To do this, we need the best available technology, for instance in lowering energy use for recycling paper, a major cost in the process. At Smurfit Kappa, we strongly believe in recycling, and ideally we would want to recycle recovered paper even more than the five or six times it is used now, perhaps even up to 10 times?

ISMO NOUSIAIMEN: When you build a pulp mill, you have to look a long way ahead, as much as 40 years into the future – and we have to ask ourselves: how will we be operating then? In fact,



View video footage of this report online:

www.andritz.com/spectrum-roundtable2017





Harri Qvintus (Senior Vice President, Sales, ANDRITZ)



Sami Saarela (Vice President, Finland Operations, UPM Pulp)



Ismo Nousiainen (CEO (as of January 2018), Metsä Fibre)



Mark Rushton (Editorial Consultant, SPECTRUM Magazine)



Mat Maessen (Head of Paper Production Technology, Smurfit Kappa Group)



Bjørn Hansen (Vice President, Commercial Sales, ANDRITZ)

that was always the challenge; however, that is even greater now, as we have to think about other bioproducts that go along with the pulp mill as well. So really, the greatest challenge is to be able to have the flexibility at a mill to swap, change, and swing as and when the markets move according to product and consumer demands.

SAMI SAARELA: For us, one of our major challenges is planning and developing long-term projects when it comes to plantations. In Finland of course, forests are not a problem, but go somewhere else and they could well be a big problem. You have to be sure that the environment is safe, and that the politicians are not going to change their minds, or lose an election, and then have a leader who looks less favorably on our operations.

BJØRN HANSEN: Our main challenge is looking deeply at the trends, and deciding which ones should be pursued and which ones should be ignored. The challenge is to not spend a lot of money and effort on new technologies, but to identify long-term feasible demand. It seems as if we have got something right over the last years; we find ourselves a leading supplier in chemical and mechanical pulp, packaging, tissue, recycled fiber, and energy, so it seems we are definitely doing something right.

HARRI QVINTUS: From the service side at ANDRITZ, we never stop learning, and this is the ongoing challenge. From the

very first time we drew up a maintenance contract in Uruguay in 2005, we realized that every day, every minute of the day, could present a new challenge and we had to rise to them.

—
What would you like to see in the future that would make your operations even more successful when it comes to life cycles of equipment and technologies such as Industrial IoT?

ISMO NOUSIAIMEN: In Metsä Group, we recognize that we have to have good assets, that is why we are renewing key parts of our mills very regularly. We are constantly looking at ways to improve our performance and as a result we have been able to improve our production by two and a half times compared to an older mill. Our next challenge is to improve yield, as the major cost in our operations is raw materials.

We are already using Industrial IoT solutions to great effect. We, in fact, developed our own online quality index for pulp, which meant that we eliminated time-consuming laboratory trials, and could see our pulp quality report in real time as the pulp was being produced. I am happy to say that ANDRITZ has now taken this technology into its portfolio for its Metris offering. We are also getting much further along when it comes to using IoT in predictive maintenance, where we are getting crucial

information from sensors all over our production processes.

SAMI SAARELA: When you think of future-proofing, the pulp industry is already doing a good job – looking 40 years ahead when building a new pulp mill is pretty impressive. Also, a life cycle of 40 years is a long one for one product – a pulp mill. My feeling is that there are so many changes in 40 years that it would be best to knock the mill down and start again rather than keep replacing technology and rebuilding.

In terms of Industrial IoT, at UPM we were collecting data even more than 10 years ago, but the problem has been manpower; there is simply not the resources for mill personnel to be sifting through data all day long trying to come to a conclusion. The advent of data management systems with automation and software that allows operators to measure and manage the quality of raw material in real time is an excellent addition and I can see this being a big growth area in mills in the future.

MAT MAESSEN: The lifetime of a paper machine can be from 20 to 40 years; that is a long time. What I would like to see is paper machine manufacturers coming up with much more flexible machines, ones that can switch grades without having a rebuild, or can be adjusted much more quickly when the market conditions or consumer demands for different products change. This is the climate we have to operate in

and it would be great if the supplier recognized this and came up with a solution.

In terms of Industrial IoT, data management, and gathering, this is definitely the future for us. A perfect scenario would be to be able to constantly monitor quality, not just once an hour as the older measurement systems do. In our world, consistency is absolutely key, and if we can maintain quality and keep in the “flat lining area” allowing us complete control of the process, that would be a dream. It would also be a major advantage if costs could also be reported, for instance, when adding more chemicals to a process, so operators could take more responsibility for their actions.

BJØRN HANSEN: As a supplier to the pulp industry, a 40-year life cycle is terrifying; what are we going to do in those 40 years? Of course, there is plenty of other work to do, on improving yield, and on new, adaptive technology such as swinging from kraft pulp to dissolving pulp. Also, for instance, water has become an increasingly important issue; we have been proactively working on this. In the 1970s, water use was up to 100 m³ per tonne pulp produced, now we have it down to around 10 m³. We are also closely working on packaging technology and on efficient ways to convert graphic paper machines into packaging machines.

In terms of Industrial IoT, or our ANDRITZ offering, Metris, we are speaking to a lot

of customers about solutions for quality measurement, predictive maintenance, and optimization of, for instance, process chemicals which they can see are really helping to level out the imbalances across the mill. We see this as an exciting, growing area for us.

HARRI QVINTUS: The major area we have been working on with customers and the service side is on maintenance shutdowns. It used to be the case that a mill would shut down two or three times a year, now that has extended to once every 18 months, or even two years. We have learned so much over the last few years about managing shutdowns, so that the maximum amount of replacements and service can be carried out in the shortest possible times. What we have clearly learned is that these shutdowns are not just about speed of service, they are also about the quality of the spare parts – which have to be of the very best quality to ensure efficient operation for another long period of uptime at the mill.

Our Industrial IoT offerings through Metris are now becoming key components in maintenance and service, both in predictive and preventative maintenance. We have sensors now that are reporting in real time the status of bearings and pumps, motors and machines, as well as all sorts of measuring for the efficient management of the processes.

Summing up: A Bright Future Ahead

A number of points came out of our Future-Proofing discussion in Vienna. One of the highlights that was clear to see from our panelists' views is that the pulp and paper industry has an exciting future ahead, driven by people who are completely committed to their individual strategies, and with a solid belief in the environmental attributes of the industry. Another highlight was the fact that the leading pulp and paper companies are already fully engaged in the concept of future-proofing; in fact, most of them have been doing it in one way or another for decades when looking ahead at major expansion plans.

With the opportunities the future holds when it comes to growing markets and new products, combined with a cautious, but healthy attitude to the adoption of new, game-changing technology, we can be sure that the future of the pulp and paper industry is in safe hands, from both producer and supplier perspectives.

[The SPECTRUM ROUND TABLE on the Future-Proofing of the Pulp and Paper Industries is the first in a series of regular round tables.](#)

Eldorado
Celulose

SELF-DRIVING MILL



There is a lot of news available about Google, Uber, and the automobile manufacturers' efforts to develop autonomous automobiles (i.e., unattended and self-driving vehicles capable of sensing their environment and navigating without human input). On the other hand, there has not been much news about efforts to develop an Autonomous Pulp Mill. Until now.

The development of the Autonomous Mill is following the same path as that of the autonomous auto. First, smart sensors and instruments were required to reliably collect data. Next came secure and robust communications methods to move the data from the mill floor to a control computer, and back. And now comes the software and human expertise to combine equipment data with data pulled from process computers (DCS) and data mined from a mill's enterprise-wide computer (ERP) to "navigate" the best path for production and profits. That software/service is called Optimization of Process Performance (OPP) and is offered by ANDRITZ.

OPP has been around for over a decade, and is being implemented in various forms at about 50 mills around the world. However, the most ambitious – and arguably the most impressive – work just completed its

first year of testing as the Autonomous Mill project at Eldorado Celulose's mill near Três Lagoas (MS), Brazil.

AUTOMATED – AUTONOMOUS

Autonomous means self-governance: satisfactory performance despite uncertainties in the environment – with the ability to compensate for system failures without external intervention.

"Autonomous implies acting independently," explains Leonardo Soares Figueiredo, ANDRITZ's OPP Project Manager at Eldorado. Figueiredo is a member of a new group within ANDRITZ called ANDRITZ Process Optimization (APO). "Most of our work at Eldorado to date still has an operator in the driver's seat, so perhaps 'automated mill' more accurately describes what we are doing today – with an eye toward autonomy in the future."

Carlos Monteiro, Eldorado's Industrial Director, does not care whether it is autonomous or automated. Monteiro is focused on results. "I can tell you this," he says, "the results in the first year have been impressive."

Bottom line: an increase in operational efficiency from 89.2% to 93%; variable cost reduction of 5%; 38,000 admt production over the budgeted amount; controls in automatic mode 95% of the time.

OPP A "BIG DIFFERENCE"

A 3.8% boost in operational efficiency may not sound like much. But in a mill designed to produce 1.5 million t/a – and currently producing 1.7 million t/a – that amounts to millions of Brazilian Reals. That Eldorado operates sustainably at 13% above design without any additional capital investments is testament to the efficiency.

Why does a mill operating in the top-tier globally choose a service such as OPP?

"We are single-line mill," says Leonardo Pimenta, Technical Control Manager at Eldorado and the leader of the OPP project. "We are well-managed and have tight cost controls. But we can always improve our position. We focus on every detail to stay ahead of our competition. OPP is a tool for helping us stay ahead."

AUTOMATIC MODE IS CRITICAL

"Central to achieving results is the knowledge that processes are better controlled by automatic advanced process control strategies compared to operator intervention," says Pimenta. "Stability is a key issue in a mill. The fewer surprises, the better the performance. Every loop in auto makes us money."

When ANDRITZ proposed a pilot project on the Eldorado fiberline, the main targets were: 1) that all main processes would be controlled by Advanced Process Control (APC) strategies; 2) that over 95% of the control loops would be available in automatic mode; and 3) that the APC routines would be turned on at least 90% of the time.

"We believed that if we could achieve those targets, our operational stability would be

over 90% and our variable costs could be reduced between 5-10%," Pimenta says.

"They were pretty high targets, especially for a well-run mill," Figueiredo admits. "But, Eldorado and ANDRITZ were both committed to achieving them. We signed an agreement in August 2016 with the idea that we would have all the front-end work done by the end of the year so we could start measuring results in January 2017."

"PUT ALL OUR EFFORT INTO THIS"

There are various "flavors" of OPP in various mills, according to Arthur Santos, OPP Technical Specialist at ANDRITZ, ranging from evaluation and tuning of control loops to more complex data mining and integration of separate mill databases. The one thing in common is that

the work is done in collaboration with mill personnel – operators, technical resources, and management.

"However, Eldorado is unique in that from the very beginning we formed a joint team that works together daily," Santos says. "In the same room you can find Eldorado process engineers and maintenance reliability engineers and ANDRITZ OPP analysts. We interact constantly, collaborating and solving problems together."

According to Pimenta, when Eldorado decided to go with OPP, it did so in a big way. "We chose to apply all the concepts and all the technologies that OPP offers at the same time," he says. "We didn't want to do it in pieces, but all at the same time and as fast as possible. That's the Eldorado way."

Leonardo Pimenta, Technical Control Manager, meets with the OPP team to discuss progress. The team consists of Eldorado process engineers, reliability engineers, and ANDRITZ OPP analysts working side-by-side.





Eldorado Celulose's senior management team (left to right): Luiz Roberto Araujo, Maintenance; Marcos Steyer, Woodyard and Chip Preparation; Murilo Sanches, Recovery, Utilities and Energy; Leonardo Pimenta, Technical Control Manager; and Marcelo Martins, Production Manager.



(Left to right): Luiz Roberto Araujo, Maintenance Manager; Fabio Castro Soares, Instrument Technician; and Rafael da Silva Teodor, Electrical Maintenance Specialist, look on as Reliability Engineer Uliam Mazzardo Veloso shows the asset risk profile that is updated in real time in the OPP system.



Daniel Scigo of Eldorado, demonstrates a new smart sensor (an online shive measurement device) that is a new input to the APC strategy for Eldorado's fiberline. This ability to easily add new variables into existing controls is part of the OPP software strategy leading to an Autonomous Mill.



Ernandes Silva, Fiberline Operator (left), with Ederson Reis, Technical Assistant for Fiberline. After implementing OPP's advanced control, the digester has run with excellent stability and purges of the third screen have been eliminated. Several production records have been broken in 2017 after the implementation of OPP.

FRONT-END WORK PAYING OFF

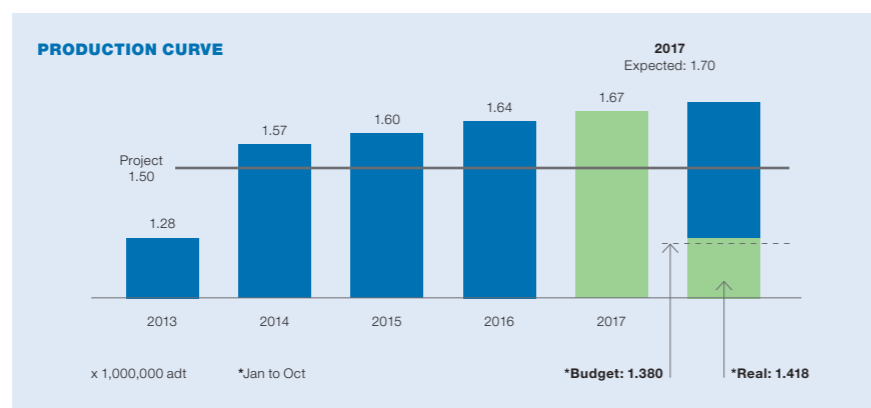
Santos believes that the front-end work of analyzing control loops and then "tuning" each loop is responsible for helping achieve the results Eldorado is seeing today. "It all starts with reliable data, which comes from reliable instruments and sensors," Santos says. "We completed over 40 projects using combinations of smart sensors, APC, loop tuning, data mining, etc., that that created the infrastructure and a standardized way of operating."

The OPP team started the development of APC modules for the fiberline processes. Causticizing and the drying machines were added later. By January 2017, 25 APC routines were completed developed and more than 50 loops tuned, progressing the fiberline from basic control to "hands off" and even "eyes off" operation so that operators could safely turn their attention away from mundane control tasks.

Was there ever a moment when operators resisted the Autonomous Mill project or feared for losing their jobs?

"Not really," says Pimenta. "This is not about replacing an operator; it's about re-assigning an operator to have time for more highly leveraged tasks. If you think about it,

even the best operator in the world can't be alert and on duty 24/7/365. An automatic control loop can. However, it is very important to have a high-performing team, strong leadership, and the right culture for this mindset to work well. People are our focus and our competitive advantage. So, changing the management model of a modern industry is a challenge and this must be taken into account."



FIBERLINE STABILIZED

Ederson Reis, Eldorado Technical Assistant for Fiberline, was active in seeking the input from operators and explaining the benefits to them. "We involve operators in every phase," he says. "They quickly began to see how automatic control makes their jobs easier."

An example is a problem that Eldorado was having with the hydraulic balances inside their massive digester. "We used to have to backwash the third screen in the digester every three days, which cost us time and production," Reis says. "After implement-

ing digester APC about one year ago, the digester has run with excellent stability. We have not had to purge the screen, so operators can work on preventative actions and more valuable things."

SUPPORT FOR RISK-BASED MAINTENANCE

Luiz Roberto Araujo is Maintenance Manager for Eldorado. He has three Reliability Engineers from his group working on the OPP team in a project to support the mill's culture of Risk-Based Maintenance by centralizing information from the process and the equipment in the same database.

Sounds easy enough, but the volume of work is quite challenging. ANDRITZ OPP analysts have tapped into the mill's SAP maintenance planning software to get vital information about Eldorado's 23,000 assets in the database and combine this with process information from the DCS. The team is working to make this a two-way communication between the databases.

"This gives us a new level of knowledge about our assets," Araujo says. "Understanding the process is fundamental to understanding the health of our mill. Identifying the risks early avoids unplanned stops."

The team has categorized each asset A, B, C, or D depending upon the critical importance of the equipment to the mill's operations. "We monitor the risks for each asset, and focus our attention on the highest priority risks to our most critical assets," Araujo explains. "One glance at a computer screen shows us where to focus our efforts to avoid unnecessary shutdowns."

The result? "We're operating at 95% overall equipment availability," Araujo says. "That is an excellent result."

KPIs MET

Early in the project, Eldorado and ANDRITZ set clear goals against which to measure success. These goals, known as Key Performance Indicators (KPIs), form the basis for 30% of ANDRITZ's compensation, so are important. What gets measured gets done.

"Setting the correct KPIs requires very open discussions between a mill and us," says Luis Binotto, Senior Vice President of ANDRITZ's APO group. "Their targets are our targets. There is only one team here."

The three KPIs selected most critical are: 1) operational stability in the 90-93% range; 2) a reduction in variable costs vs. budget; and 3) all the APC routines will be turned on at least 90% of the time.

There is a very definite correlation between OPP and operational stability – which leads to higher throughput. In less than one year, some important milestones were achieved:

a new record for quarterly production from January to March; a new monthly production record (average 5,045 admt/d) in May; a new quarterly production record from April to June; and in August a new average production record of 5,105 admt/d was set.

ALWAYS MORE TO DO

Underway now is an OPP project to determine the best Production Mill Balance at any given time. "Think of it as level control for the entire mill," says Santos. "We are writing software to monitor all the tank levels in the mill and combine this information with key process variables. This will guide us in knowing when to increase or decrease production of specific processes. At first, this will be a decision-support tool. But as supervisors gain confidence in it, it will run autonomously, precisely ramping processes up or down to keep Eldorado at optimum production."

In addition to Mill Balance, there are projects involving the lime kiln, recovery boiler, bleach plant, and drying machines.

"We are also working on an Augmented Reality (AR) project to help maintenance people get instant information in the field simply by looking at a piece of equipment with AR glasses," Pimenta says. "And we are quite far along with making checklists for operators and maintenance people available on their mobile devices."

"A BIG DIFFERENCE"

According to Monteiro, OPP has made a "big difference" in Eldorado's performance.

"In a short time, we have achieved excellent results," he says. "Every loop in APC makes us money. Selfishly, I would prefer if no other pulp mills would investigate OPP. But even for those who do, we intend to keep pushing, and to stay ahead."

"I suppose there are some people who believe that the Industrial Internet of Things (IIoT) is just a marketing gimmick," says Daniel Schuck, Vice President of Technology for ANDRITZ APO. "Maybe they said the same thing about transmitters and early distributed control systems. But what we are doing is not pie-in-the-sky fantasy. We are using new tools to do traditional things – saving mills millions of dollars a year."

"The commitment of our operational team was fundamental to this project," Pimenta says. "We might have tried to do some of this alone, but we chose to bring in an experienced partner with ANDRITZ. They have the tools and the experience to help us reach a much higher level of performance faster. I don't see any good reason to wait. Our results show that there is a lot to be gained by extracting the hidden capacity from our assets before having to make additional capital investments."

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Global Trends in

DISSOLVING PULP

BY
**RODNEY
YOUNG**
—
RISI

The turnaround of dissolving pulp supply and demand over the last decade has been nothing short of amazing. World demand for dissolving pulp began trending steeply upwards in the early years of the current decade and has continued to grow above the rate of GDP. A lot of the increase in demand is due to substitution for cotton. The current estimate is that dissolving pulp demand will hit 7.6 million tonnes this year.

1 Dissolving pulp may be broadly classified as viscose pulp, which is used to make viscose staple fibers, and hi-alpha or specialty pulp, which is used to make a broad array of higher valued products such as acetate tow for cigarette filters, cellulosic ethers used as additives in a number of materials, and nitrocellulose. Viscose pulp has accounted for the vast majority of the demand growth in dissolving pulp over the last 15 years, boosted by share gains for viscose staple fibers in the world textile fiber market. Most of these gains have been at the expense of cotton, especially in the 2010-2013 period when cotton prices were high and supplies were limited. Viscose staple fibers are being used in a broad range of products, including apparel, household furnishings such as bedding, and nonwovens wipes. The development of viscose fibers with superior product characteristics, led by lyocell and Tencel, is adding to the growth from traditional viscose staple fibers.

NORTH AMERICA is the second-largest supplying region for dissolving pulp, with an estimated 1.8 million tonnes of production in 2017. The USA is expected to account for two-thirds of the total, or 1.2 million tonnes, and Canada the remainder.

AFRICA is the next-largest producing region with all of the production confined to one country, South Africa. The biggest dissolving pulp mill in the world is located in South Africa and a paper grade pulp line at another mill was recently converted to dissolving pulp.



EUROPE is expected to nearly match North American dissolving pulp output in the current year, producing 1.7 million tonnes of dissolving pulp. European production has doubled since 2010 based mainly on a slew of conversions from paper grade to viscose pulp on existing pulp lines.

CHINA is the largest producing country for dissolving pulp, it is also the largest consuming country. Estimates for this year are that China will produce 1.9 million tonnes of dissolving pulp, accounting for 25% of world output.

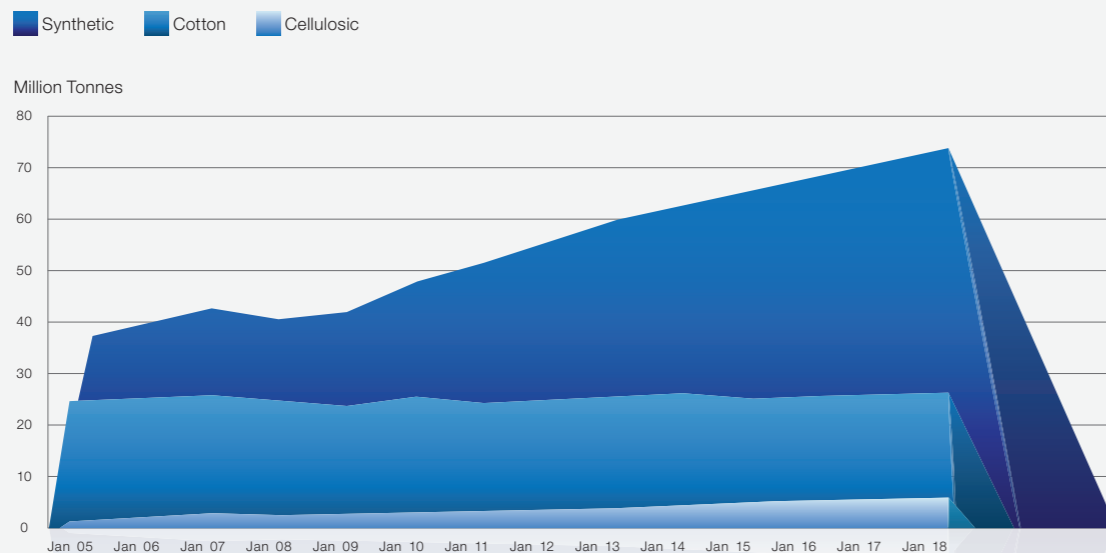
2 Global demand for hi-alpha pulp has also increased over the past 15 years although at pedestrian pace compared to viscose pulp. Usage of acetate pulps for cigarette tow rose relatively rapidly through the middle part of this decade due mainly to increasing consumption of cigarettes in China and more filters being applied. However, rising taxes on cigarettes by the central government becoming increasingly concerned about health issues have resulted in a recent reduction in cigarette consumption in that country. Ether pulps are still associated with demand growth slightly above GDP growth, focused on the pharmaceutical and food sectors increasing their usage of cellulosic ethers as additives.

3 China is still the largest producing country for dissolving pulp, reflecting in part the fact that it is also the largest consuming country. The estimate for this year is that China will produce 1.9 million tonnes of dissolving pulp, accounting for 25% of world output. Dissolving pulp production has jumped 700,000 tonnes from 2010 after stagnating in the second half of the last decade. The vast majority of Chinese dissolving pulp production used to be based using cotton linters but wood-based output now dominates due to its lower costs. Investment in new wood dissolving pulp by Chinese producers has been encouraged by strong domestic demand growth and tariffs on American viscose pulp suppliers since 2014.

4 Dissolving pulp production is predicted to expand in all regions over the next five years. China and the remainder of Asia are expected to show the largest gains at 600,000 tonnes each. Greenfield mills are scheduled to start in China and Laos next year, while major conversions will take place in China and Indonesia. Latin America will closely follow the expansion in Asia in response to a large paper grade pulp mill in Chile being converted to dissolving pulp. Almost all, if not all, of the new capacity entering the dissolving pulp market is capable of swinging between paper grade and dissolving pulp. The technological advances that allowed mills with continuous digesters to be swing operations has virtually ensured that any new capacity will take advantage of that flexibility.

WORLD TEXTILE FIBER DEMAND

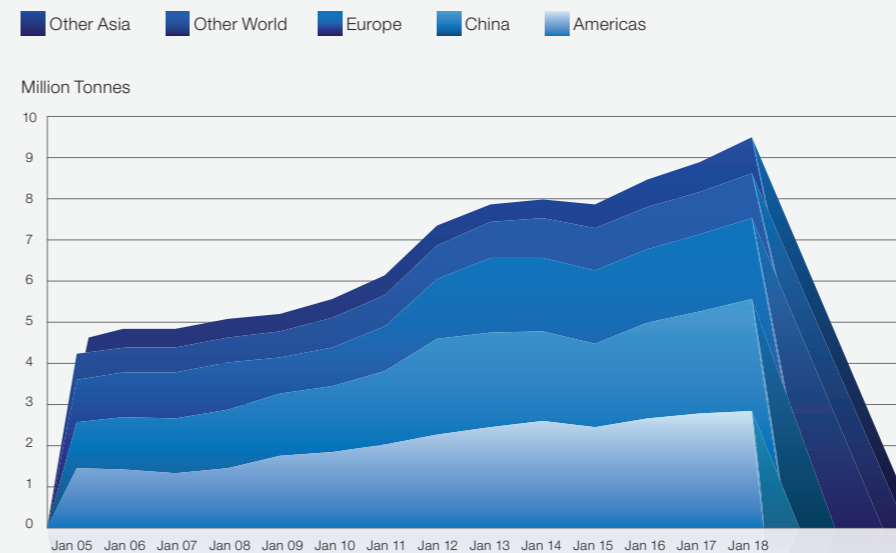
World textile fiber demand showing dissolving pulp fiber still some way behind synthetic and cotton fiber demand, however, with plenty of steady growth opportunities.



Tables and Graphs: RISI; For more information, go to: <http://www.risiinfo.com>

WORLD DISSOLVING PULP CAPACITY

China leads the way in dissolving fiber production globally.



RODNEY L. YOUNG
CHIEF ECONOMIC ADVISOR - FIBER,
GRAPHIC AND PACKAGING PAPER,
RISI

Rod Young started modeling and forecasting in the pulp and paper industry in 1977. Since then, his work in international pulp and paper markets has received worldwide recognition. Rod now consults on a regular basis with companies throughout the world. He continues to assist in the development of the RISI analysis and forecast of the world pulp and paper market, along with working on individual projects. In addition, Rod is the primary person responsible for the RISI analysis of the global dissolving pulp market.

PROVEN METHODS

for removing chloride and potassium from the recovery loop

In modern kraft recovery operations, the key sodium and sulfur compounds from the fiberline are recovered and regenerated to minimize the need for makeup chemicals – and to also produce renewable energy in the process. Chemical recovery loops are becoming more and more efficient such that emissions, effluents, and waste streams are minimized.

The tightening of these recovery loops creates new challenges as non-process elements (NPE) accumulate in the liquor circulation. Two of the most potentially harmful NPE are chlorides (Cl) and potassium (K). In high concentrations they can cause severe corrosion of recovery boiler heat exchangers. They also lower the melting temperature of the boiler fly ash, increas-

ing fouling and potential for plugging the tight flue gas passages.

The traditional – and expensive – method of controlling the concentration of chloride and potassium is by dumping a portion of the ash from the boiler's electrostatic precipitators (ESP). Dumping presents at least two very real issues: 1) two valuable process

chemicals, sodium and sulfate, are dumped with ash, and 2) the dumping can create environmental concerns.

REMOVE AND RECOVER

ANDRITZ offers two economic and environmentally attractive solutions to effectively remove chlorides and potassium and recover sodium and sulfate from the ESP ash.

Selecting the most suitable technology for a mill is always case-specific, depending mainly on removal capacity needs and mill process characteristics.

The recovery of process elements and the removal of non-process elements is possible primarily due to the solubility differences between alkali sulfates and alkali chlorides. The general idea is that chloride and potassium are removed as liquids, while most of the valuable sodium and sulfate is recovered as solids and led back to the chemical recovery cycle.

ASH LEACHING (ALE) TECHNOLOGY

For lower capacity requirements and generally for retrofit installations, the ALE process is less expensive to install and assembly is simpler. In ash leaching (Figure 1), the ESP ash is partially dissolved in hot secondary condensate from the evaporators. After partially dissolving, the solids and liquid are separated using a centri-

fuge. The solids consist mainly of sodium sulfate while the filtrate is rich in chloride and potassium.

After separation, the solids are mixed with heavy black liquor. A part of the liquid fraction is purged from the system to remove Cl and K. The rest of the filtrate is recycled to the leaching tank in order to prevent excess dissolution of sodium from the ESP ash.

Good solid-liquid separation is crucial, because the ash is only partially dissolved and the sodium sulfate particles in the ash are very small. A decanter centrifuge is employed for efficient solid-liquid separation.

If the carbonate content of ESP ash is too high, sulfuric acid can be added to the slurry to convert the sodium carbonate to sodium sulfate. When ash is leached without acid addition, the more carbonate there is in ESP-ash the poorer is the

separation – meaning that chloride and potassium rich liquid returns to the mill's liquor cycle.

A typical ALE system has removal efficiency of 85% with a sodium loss of 25%. The best performance can be reached by optimization of the ash water ratio and recirculation to the leaching tank.

ASH RECRYSTALLIZATION (ARC) TECHNOLOGY

A typical ARC system has removal efficiency of 90% with a sodium loss of 20%. ARC technology can also handle larger capacities, making it the better choice for larger retrofits or greenfield installations.

In the ARC process (Figure 2), the ash is completely dissolved in clean condensate (or another calcium-free water source). After dissolving, the ash solution is pumped to a crystallizer where water is evaporated until sodium sulfate pre-

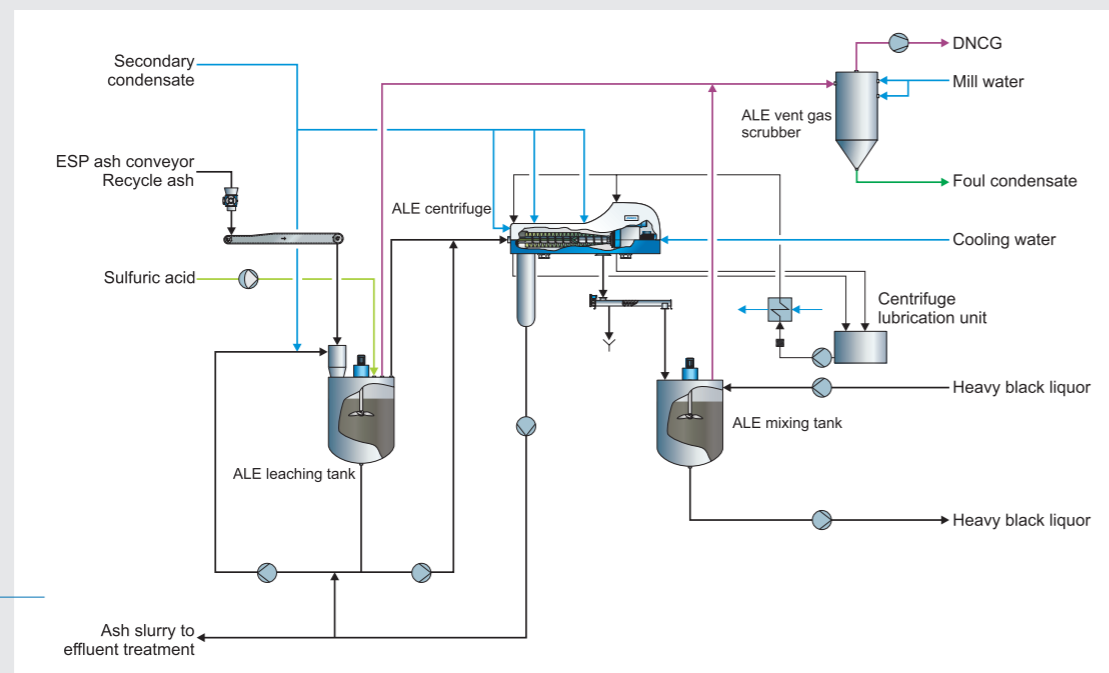


Figure 1: Simplified flowsheet of the ALE process.

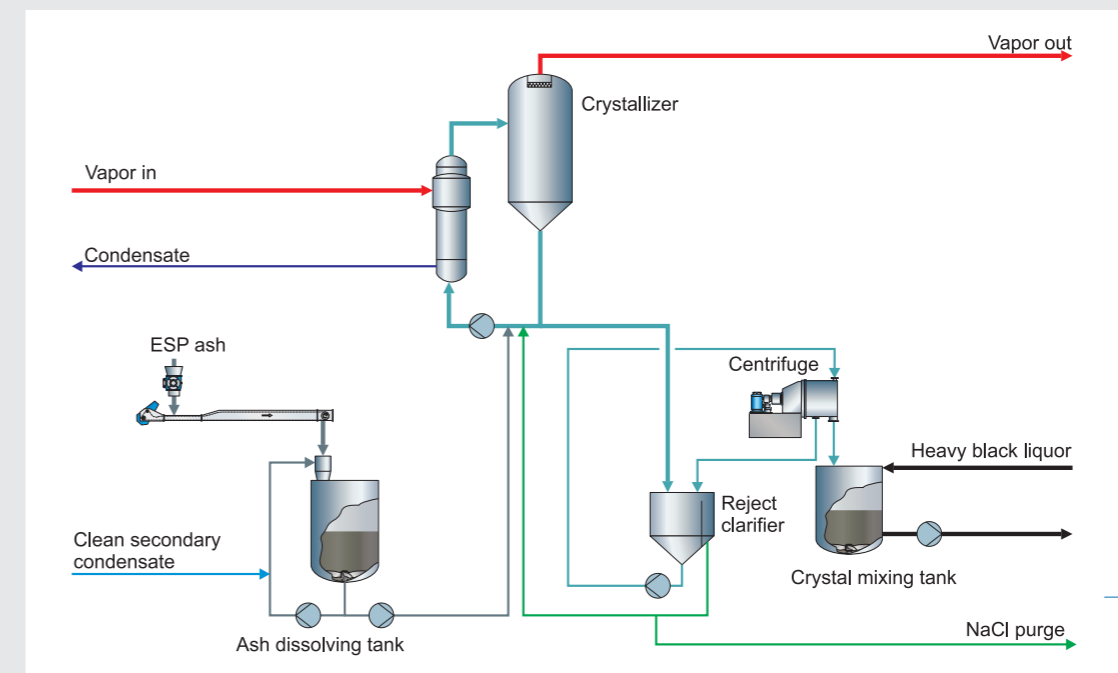


Figure 2: Simplified flowsheet of the ARC process.

precipitates from the solution. Precipitated crystals are sent to a thickener and separated with a pusher centrifuge. Most of the separated liquid is recirculated to the crystallizer to minimize sodium losses. The remaining liquid is purged to remove dissolved chloride and potassium from the liquor cycle.

In new installations, the ARC process is usually integrated into the evaporation plant to decrease the fresh steam consumption of the crystallization process (an integrated system requires only 35-40% additional steam compared to a crystallizer operating standalone). Heat for the crystallizer can also be taken from flashed green liquor vapors, which might be a good option if there is a need for green liquor cooling.

EXPERIENCE

Operating a leaching or crystallizer type of chloride removal system is a trade-off between removal efficiency and sodium recovery, but generally ARC is more effective compared to ALE (Figure 3).

Potassium removal can be more challenging than chloride removal because of the formation of different solid potassium compounds. When the potassium mass fraction of ash is less than 3.5%, the removal efficiencies for chloride and potassium are quite similar. Higher potassium concentrations can form compounds that precipitate from the solution and decrease the removal efficiency.

Sufficient lowering of Cl and K levels in kraft recovery circulation can take several weeks or even months (Figure 4). Since the

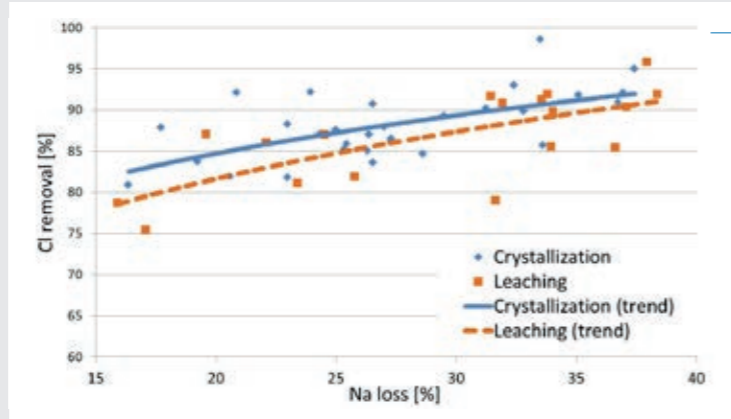


Figure 3: Chloride removal efficiency as a function of sodium loss – actual mill experience.

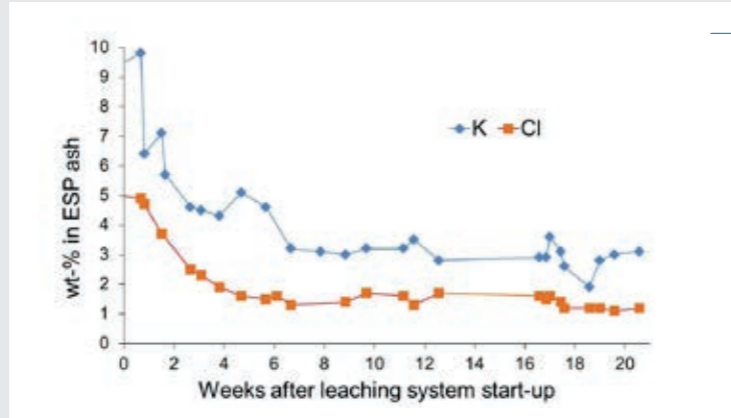


Figure 4: Cl and K concentrations in ESP ash after ALE start-up.

changes are not immediate, the chloride and potassium removal system can be shut down without interfering with recovery boiler operation. Also, if the need for Cl and K removal decreases over time, the system can be operated periodically to keep the concentrations at targeted levels.

CONCLUSION

The ALE process is relatively simple, and well proven. Its small footprint is ideal for retrofits and is more readily integrated into

an existing recovery boiler layout. When the need for ash treatment capacity increases, the solid-liquid separation of the leaching system can become a bottleneck.

The ARC process is generally more suitable for larger chloride and potassium removal needs. Evaporated crystals are also predominantly pure sodium sulfate (Figure 5), so the recovery and removal efficiencies are also better.

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Figure 5: Photo of leached ESP ash (left) and recrystallized ash (right).

GOING VERTICAL

The latest innovation in dewatering

Every piece of production equipment in a mill has a range where it performs extremely well, and also mechanical limitations where performance is less than optimum. Building on technical strengths and overcoming limitations are what motivates ANDRITZ engineers to innovate new designs – such as the VST.



With over 500 units in operation, the ANDRITZ Screw Press (SCP) is regarded as being top of the line. But, even a premiere product has practical limits. In the case of the SCP, the limitation could be observed in applications with lower feed consistencies (e.g., 3-6%).

“How can we remove the limitations in lower feed consistency applications – while keeping the inherent design strengths of the SCP?” That was the question that ANDRITZ engineers answered when developing the VST.

THE IDEA BEHIND DEVELOPMENT OF THE VST

Simply described, the VST is a vertical configuration of the SCP, with some important differences. In an SCP, the pulp suspension is fed into the inlet housing of the unit and dewatered via a rotating screw that tapers to increase the dewatering effect on the pulp. Feed consistencies are typically in the range of 5-10%. The dewatered pulp is discharged by gravity from the outlet casing

at the end of the rotating screw. Typically, outlet consistencies in the range of 26-30% are achieved.

The horizontal design has two main limitations: 1) at low feed consistencies (3-5%) the holes of the screen baskets in the inlet zone tend to plug; and 2) there tends to be uneven filling of the press across the complete area of the dewatering screen. These two limitations reduce the throughput and discharge dryness of the pulp. The VST was designed to overcome these limitations in specific applications.

THE IMPACT OF HYDROSTATIC PRESSURE

The SCP is fed from the top through the headbox into the first dewatering section. Due to the height difference between the top and bottom of the dewatering screen, hydrostatic pressure builds up in proportion to the diameter of the press (see figure 1). For large screw presses, this hydrostatic pressure can be up to 0.1 to 0.15 bar.

This pressure creates uneven filtrate flows around the screen circumference. There is lower filtrate flow at the top of the press where the hydrostatic pressure is low and a higher flow at the bottom of the screen basket where the hydrostatic pressure is highest. This pressure profile is consistent over the length of the dewatering screw.

Particularly in applications with low feed consistencies, the hydrostatic pressure can already be too high at the beginning of the dewatering process. The speed of the filtrate flow through the screen basket is at such a level that fibers can be dragged into the holes and build up a layer on the surface of the screen – reducing dewatering efficiency.



VST manufactured in the ANDRITZ workshop in Graz, Austria.

Another limitation of a horizontal design is the difficulty in obtaining uniform filling, and thus uniform dewatering, through the three dewatering zones (low-, medium- and high-pressure) and over the full length of the screw. An uneven filling degree means that the available screen area is not fully utilized and that no dewatering force is applied to some of the pulp suspension and the dewatering efficiency is reduced. When observing an SCP during operation, areas along the screw shaft with good dewatering (where a lot of filtrate is squeezed out) and areas where less dewatering takes place are visible.

TAKING IT VERTICAL

Often, the simplest ideas are the best. After evaluating several different design concepts to address these two limitations of the SCP in low feed consistency applications, the solution turned out to be a quite simple one: turn a horizontal SCP on its end and feed it from the top. In a vertical configuration, gravity works in a positive way: evenly distributing the pulp suspension across the full circumference of the dewatering screen and ensuring 100% filling.

In a VST, the pulp suspension is fed into the top of the machine and gravity transports the pulp downwards. The risk of plugging the inlet screen at low feed consistency applications is almost eliminated. Similar to

the SCP, the VST has a conical shaft and decreasing pitch so the pulp is compressed and dewatered as it moves downward. The pulp suspension is automatically and consistently refilled into the area between screw flights. The rotating shaft moves the pressed cake downwards to the outlet casing.

A pneumatically controlled counter-pressure ring builds up the pulp plug quickly after start-up and releases the pulp when the proper consistency is achieved. The ring pressure can be adjusted to fine-tune discharge dryness or can be quickly unloaded to avoid plugging. The result is that higher throughput can be achieved with the VST.

THE IMPORTANCE OF 100% FILLING DEGREE

The VST utilizes gravity to achieve 100% filling degree (100% of the screen area is used for dewatering). From top to bottom the filtrate flow around the complete screen circumference is very uniform (see figure 2).

Similar to the horizontal press, hydrostatic pressure increases from top to bottom of the vertical unit. Unlike the horizontal design, the increased hydrostatic pressure actually improves the dewatering effect, since higher pressure is required as the pulp suspension's consistency increases down the length of the screw. The hydrostatic pressure is enhanced by the design

of the screw shaft with lower volume at the end. This creates additional dewatering forces and results in extremely uniform dewatering around the complete circumference of the screen baskets over the complete length of the machine.

ELIMINATION OF BENDING FORCES

For screw presses, it is important to maintain a very small gap between the screw flights and the screen baskets in order



VST in the ANDRITZ pilot plant in Austria.

Figure 1: Dewatering physics of the ANDRITZ Screw Press (SCP)

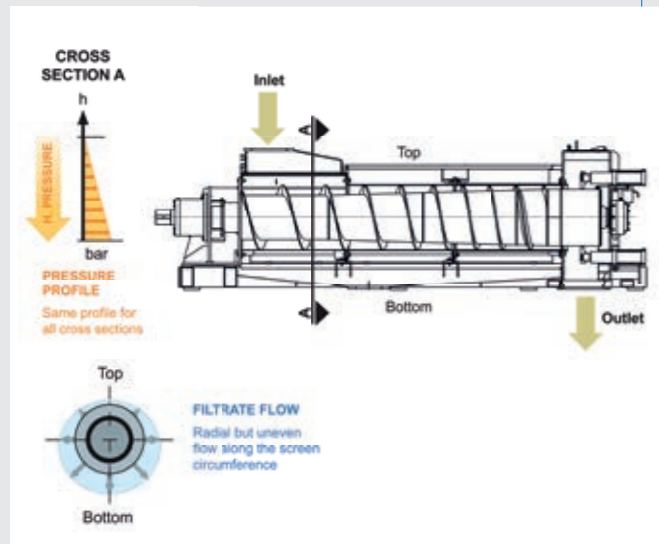


Figure 2: VST cross section and enhancement of hydrostatic pressure.

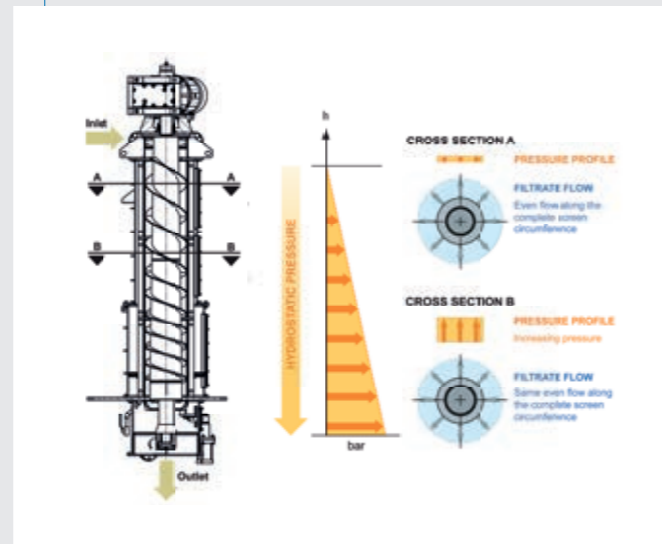


Figure 3: Increased throughput with hardwood kraft pulp (VST compared to SCP).

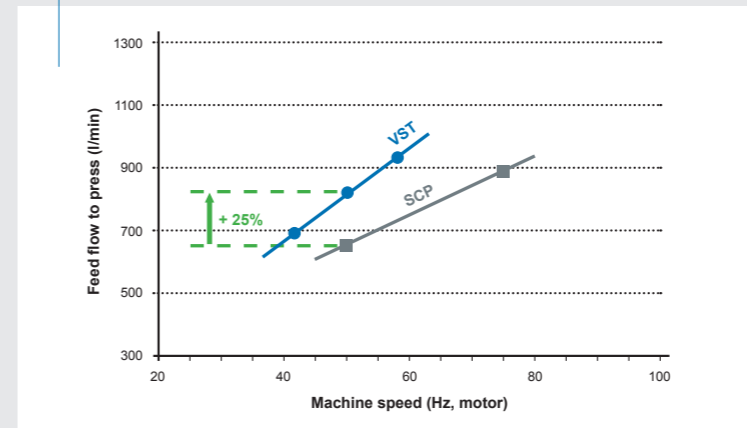


Table 1: Types of pulp that can be dewatered with the VST.

Pulp type	Kraft pulp (hardwood and softwood), OCC, deinked pulp, TMP, B(C)TMP, semi-chemical pulp
Freeness	120–750 ml CSF
Feed consistency	3–10%
Outlet consistency	25–35%
Temperature	30–95°C
pH	4–10

to achieve high dewatering efficiency. Mechanically speaking, the “dead weight” of the screw shaft itself plus uneven dewatering forces on the shaft of a horizontal SCP create bending forces and possibly deflection of the shaft.

Mechanical designers make every effort to reduce the deflection to a minimum; however, the deflection can be significant for longer screw presses (up to 10m shaft lengths). This deflection makes it difficult to maintain a small and uniform gap between the screw flights and screen baskets over the length of the shaft.

In the vertical configuration, the dead weight of the screw shaft has no impact and the screw operates with symmetrical axial forces. The opportunity for deflection is minimized and a uniform gap can be maintained over the length of the screw.

APPLICABLE TO ALL KINDS OF PULP

In 2015, a pilot VST was installed at the ANDRITZ pilot plant in Austria. The pilot machine was actually the smallest industrial size of the VST available, so that scale-up could be more readily evaluated.

Various types of pulp have been tested in the pilot plant. The conclusion is that there are no limitations on the kinds of pulp that can be dewatered with the VST under various operating conditions. Table 1 shows the range of pulp properties and operating conditions that can be successfully dewatered.

In a trial on hardwood chemical pulp, the VST was compared side by side with a traditional ANDRITZ Screw Press. Figure 3 shows the comparative results. At low feed consistency the VST demonstrated a 25% increase in throughput at the same outlet consistency over the whole range of operating speeds.

Similar results have been achieved with other types of pulp, including recycled deinked and OCC.

Pilot trials have also shown lower energy demand for the VST, which would reduce the size of the motor and gearbox. The VST design is completely closed. It is designed with unique telescoping bottom filtrate housing and split screen baskets for easy maintenance. The screw shaft also has replaceable wear shoes to enable high efficiency over a long lifetime.

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MAIN BENEFITS OF THE VST:

- Higher production – or higher output dryness at the same production – when compared with a traditional SCP of the same size
- Highest dewatering efficiency (particularly for low feed consistencies)
- 100% filling degree - screen baskets fully utilized to increase dryness and throughput
- Gravity-aided filling – uniform dewatering from top to bottom
- Uniform and consistent pulp discharge, which is beneficial to downstream processes
- Small space requirement/footprint
- Closed machine design
- Telescoping filtrate housing for easy maintenance access to screw and screens in the high-pressure zone

IF YOU GO DOWN TO THE WOODS TODAY ...

The classic children's nursery rhyme continues ... "you'll be in for a big surprise". Riikinvoima Ekovoimalaitos' new waste-to-energy plant near Varkaus in eastern Finland is something of big surprise – an ANDRITZ-supplied, top class, environmentally friendly facility, consuming 145,000 tonnes of household waste, situated in the middle of natural Finnish forests.

It has to be said; the Finns really know how to "do green". In fact, the country was ranked the world's greenest by the Environmental Performance Index (EPI) for 2016. The EPI ranks countries' performance on high-priority environmental issues, and Finland came in on top with a score of 90.68, ahead of Iceland, Sweden, Denmark, and Germany.

But the question has to be asked about the facility at Riikinvoima: why a waste-to-energy plant when there is so much wood around in Finland, particularly for use in biomass for generating district heating and electricity? "Well, what else would we do with our unrecyclable household waste?" comes the direct response from Juha Räsänen, Managing Director, Riikinvoima Waste-to-Energy plant. "In Finland we are good at recycling; we have been taking it seriously for decades, and there is a belief that this in itself would solve all the problems and the waste would just disappear. But of course, it doesn't; there is always something left, mainly plastics, that can't be reused and in this region would normally have gone to landfill.

"However – and most importantly for this Riikinvoima project – recent EU regulations mean that landfill is not allowed, and the implementation of these regulations means we needed to move fast in compliance, particularly here in eastern Finland where there is no access to any waste consuming plants."

THE VERY BEST TECHNOLOGY

Due to the EU regulations, plans were put in place to build a facility in the area, and in 2012 a company was formed from eight eastern Finnish waste collection companies as well as the company responsible for district heating in Varkaus. The plan was to build a waste combustion plant with fluidized bed technology for incinerating waste and producing electricity for 4,300 homes and district heating for around 10,000 homes. This would need a waste-to-energy facility that would have the capacity

to treat 145,000 tonnes of waste per year, which would generate 180 GWh of district heating and 90 GWh per year.

After some delays during the bidding process for the project – which meant valuable time was lost when it finally came to deciding on a supplier – ANDRITZ was finally chosen as the preferred supplier for the project, and was given just 26 months to provide the full scope of supply.

ANDRITZ Senior Project manager Olli Ryymin, says of the Riikinvoima order, "High efficiency of the boiler as well as the very best in technology to enhance environmental protection was at the top of the customer's list in the case of

Riikinvoima. In fact, our expertise in these areas is why we won this order."

ANDRITZ was asked to supply a turnkey solution for the waste-to-energy plant, which included a circulating fluidized bed boiler (CFB), waste fuel treatment and flue gas cleaning systems, steam turbine, electrification, automation, and all auxiliary systems including civil works and systems installations. In addition to the main project technology, ANDRITZ also supplied a flue gas condenser to condense water from the flue gases and increase the plant's district heat

production. The delivery was conducted from several Finnish ANDRITZ locations as well as other specialist products shipped from Austria.

"The flue gas condenser delivery includes heat recovery from the flue gases, district heat exchangers, and waste water treatment. This was a really important part of the delivery," adds Ryymin.

The flue gas cleaning system consists of an ANDRITZ TurboSorp (ESP) – a semi-dry flue gas cleaning system and bagfilter. The TurboSorp separates the acidic components from the flue gas and the bagfilter removes the dust particles.

INTERESTING TIMES

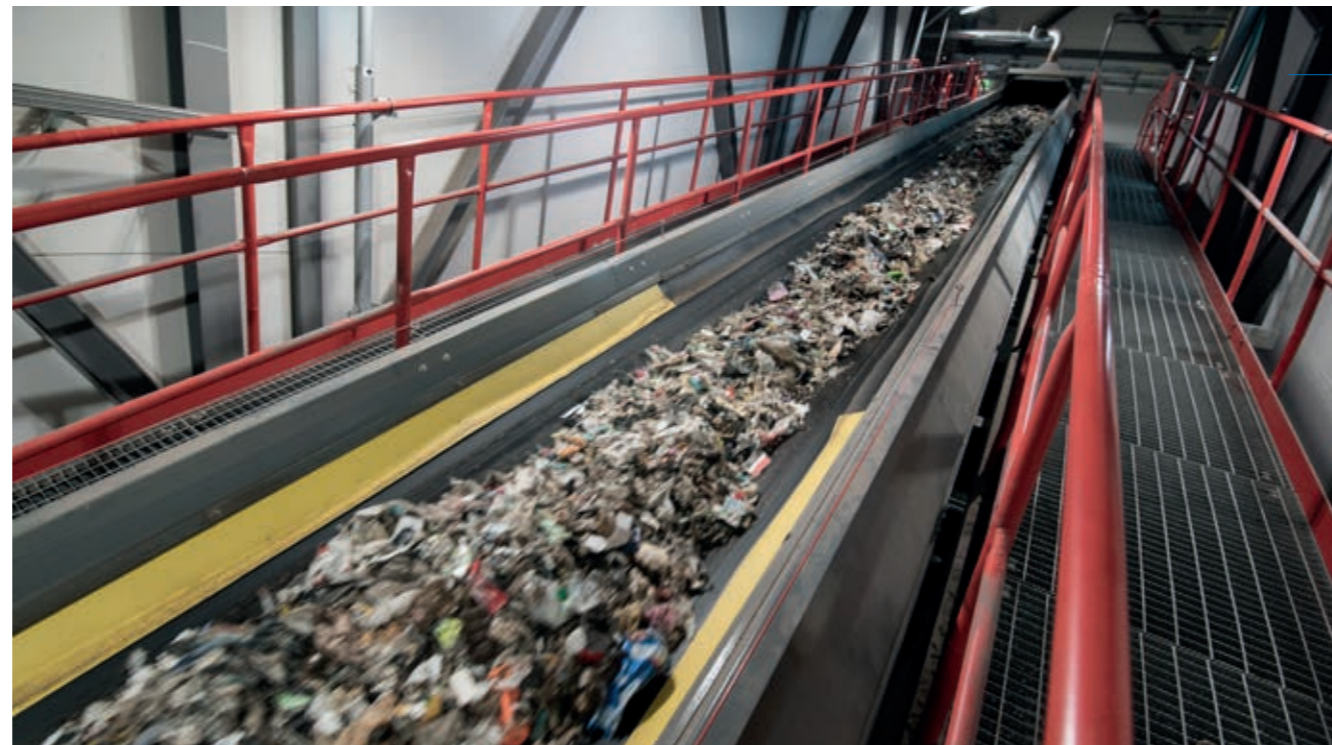
Work started on the construction of the plant in early October 2014. Räsänen says, "This was an interesting period, but before we could even start the project, we had to get everybody on board – the owners of the company and the politicians – and we needed to



Juha Räsänen, in front of the incoming waste receiving area.



ANDRITZ Recovery and Power Senior Project manager Olli Ryymin (L) with Juha Räsänen.



Conveyor belt showing the type of waste going into the plant.

The ANDRITZ flue gas cleaning system consists of ESP, a TurboSorp system (semi-dry flue gas cleaning system), a bagfilter, and flue gas condensation. The TurboSorp plant separates the acidic components from the flue gas.



ensure that everybody was aware not only of the cost, but also of the ultimate benefits of the project.

“After all that time deliberating, the deadline for the expiry of landfill permits crept ever closer and suddenly there was not a lot of time left. We had to start the project. We awarded the order to ANDRITZ on October 13, 2014, and the next day work started on the site – they had to work fast, as there was only a 26-month window to operate in before the permits expired!”

By the end of January 2015, three months later, the concrete was laid at the site and

just four months later the steel was erected followed by the boiler parts. “With regard to the erection and boiler installation, there were a few challenges,” says Ryymin. “But these were quickly dealt with. We had to be flexible during the building and installation phase; it’s the only way to keep as tight as we can on schedule.”

LET THE TRUCKS START ROLLING

In the meantime, the eight waste collection companies had been making sure all the fuel for the plant was ready and in place, with the first waste truck entering the plant – 19 months after placing the order. “We need to process about 750 tonnes of waste a

day at the plant,” explains Räsänen. “This equates to around 19 trucks a day, collecting waste from around 600,000 inhabitants in the eastern region of Finland.”

The waste is first weighed at the plant’s weighbridge and is then transported to the waste reception hall where it is off loaded into a bunker. Here the householders’ plastic bags are opened and the waste is broken up with a remotely operated grab crane. “Waste is fed into the treatment system to be able to meet the requirements of 90 mm pieces (maximum) through two stage shredding and three stage metal separation process.”

“After all this, we have treated waste with every particle below 90 mm, which is now ideal for burning and ready to proceed to the boiler,” adds Räsänen.

“OUR PLANT IS VERY ENVIRONMENTALLY FRIENDLY”

The boiler fired up on July 15, 2016, only 20 months after placing the order - and since the start-up, it has consumed around the full capacity of waste at 145,000 tonnes. Räsänen says, “Looking at the figures from August 2016 to August 2017, we treated 130,000 tonnes. We had six months commissioning time in that first year, so we are delighted considering that the start-up time

is included as well. We also managed to provide the bulk of the heating to Varkaus during the last winter.

“As far as emissions are concerned, we monitor them online measuring carbon, nitrogen, hydrochloride, and carbon monoxide. Emission limits are very tight since we are burning waste and these limits are set by EU. Our online displays show a red line if any element exceeds the limit, and we monitor this continuously. Because of this, we can clearly say that our plant is very environmentally friendly.”

As far as the day to day running of the plant goes, there are still a few small things out-

standing, mostly to do with getting the waste through in the most efficient way. Räsänen concludes, “Emissions are low and energy and heat production is in good order. It has been a major learning curve for all of us, as we knew nothing about waste management at the beginning of this project. I can definitely say that we have invested in the right technology and we have well-trained people operating the plant, always taking steps to ensure that the very latest knowledge and information is available to them.”

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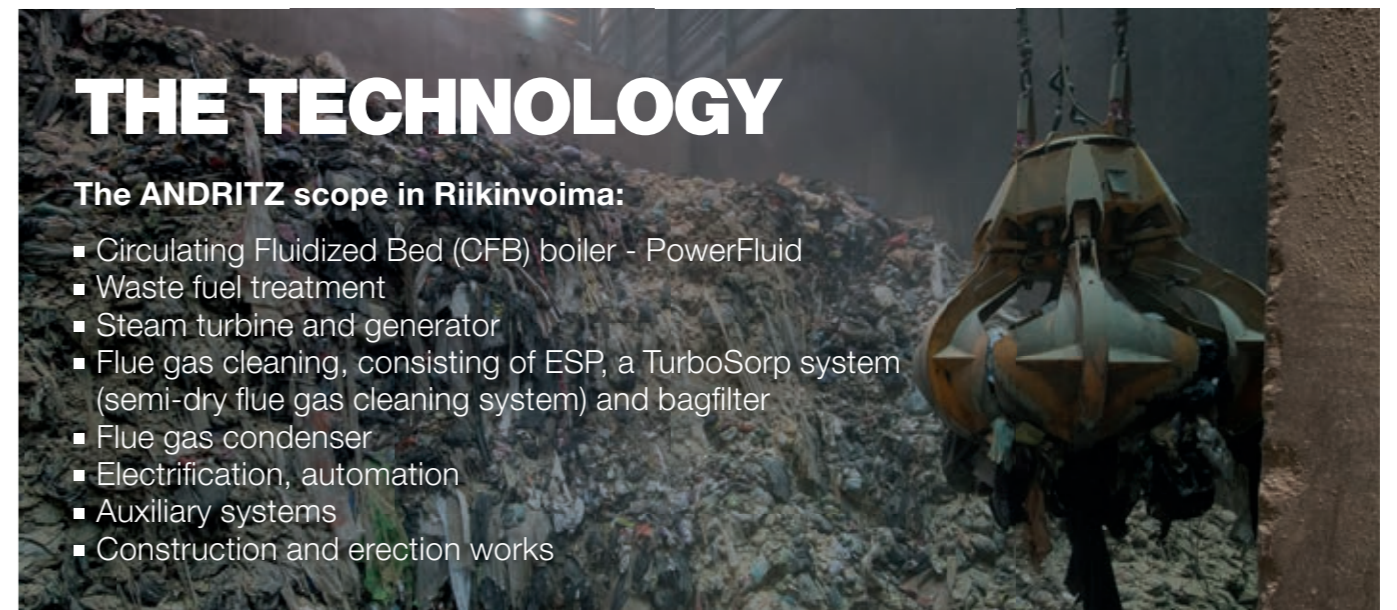
JUHA RÄSÄNEN
Managing Director
Riikinvoima Waste-to-Energy plant



THE TECHNOLOGY

The ANDRITZ scope in Riikinvoima:

- Circulating Fluidized Bed (CFB) boiler - PowerFluid
- Waste fuel treatment
- Steam turbine and generator
- Flue gas cleaning, consisting of ESP, a TurboSorp system (semi-dry flue gas cleaning system) and bagfilter
- Flue gas condenser
- Electrification, automation
- Auxiliary systems
- Construction and erection works



Highlights

NEW ORDERS

COMPLETE LINES AND SYSTEMS

Aditya Birla Domsjö Fabriker, Örnsköldsvik, Sweden
Brown stock washing upgrade at Fiberline, delivery includes a new DD-Washer

Monalisa, Jeonju, Seoul, South Korea
Sludge handling system for a tissue production line

Navigator Pulp Figueira
Figueira da Foz, Lamos, Portugal
Major fiberline modernization including three new DD-Washers
EPC project at existing mill

Nine Dragons Paper Holding, Taicang, Chongqing, Quanhou, Yongxin, Dongguan, China
Design, supply and supervision (EPS) of five multi-stage flue gas plants after reject/sludge fired CFB boilers

Iggesund Paperboard, Iggesund, Sweden
New evaporation plant and re-build of the existing evaporation plant
The new 7-effect high dry solids evaporation plant will replace an existing evaporation line and significantly enhance energy efficiency

Ilim Pulp Bratsk, Bratsk, Russia
Woodyard equipment delivery and automation equipment for maximizing fiber yield and improving efficiency of the woodyard
The most modern woodyard in Russia

Sappi Saiccor, Saiccor, South-Africa
Fiberline bleach plant rebuild

Shangrao Lulin, Shangrao city, Jiangxi province, China
OCC line
Complete OCC line with a capacity of 1,200 t/d

Stora Enso Imatra, Imatra, Finland
New flash drying line including ANDRITZ Twin Wire Press, Fluffer and Flash Dryer

Vajda Papír, Dunaharaszti, Hungary
PrimeLineCOMPACT tissue machine with PrimePress XT Evo shoe press and complete stock preparation system;
Turnkey supply

EQUIPMENT/UPGRADES

Borregaard AS, Sarpsborg, Norway
Fuel change to natural gas and NOx emission reduction of the SODA boiler

Canfor Pulp., Northwood, Canada
Supply of electrical engineering services for Steam Turbine Generator System

Cartiera del Chiese, Montichiari, Italy
PrimeFlow SW headbox and shaker unit

Century Pulp and Paper, Lalkua, Uttarakhand, India
PulpVision
First regional instrument order

Century Pulp and Paper, Lalkua, Uttarakhand, India
LimeKiln ACE
First regional APC order

Favinio., Crusinallo, Italy
PrimeCal Soft Calender

Hadera Paper, Israel
PrimeCal Hard Calender

Internatioal Paper, Bogalusa, Alabama, USA
DCS upgrade, with Simulation, Advanced Process Control, and Engineering

Khanna Paper Mills, Amritsar, Punjab, India
DIP line rebuild
Capacity increase of an existing DIP line from 250 to 400 t/d

Mariysky Pulp and Paper Mill, Volzhsk, Russia
Stock preparation rebuild of a sack kraft paper production line
Modernization of 2-stage LC refining process

Sappi Southern Africa, Umkomaas, South Africa
Hot water shower, headbox modification, new baling line C5

Stora Enso Ostroleka, Ostroleka, Poland
ANDRITZ Franssons FRX shredder
Repeat order

UPM GmbH, Schongau, Germany
Engineering and equipment for DCS upgrade for PM7

LARGEST PULPING LINE IN THE WORLD

starts up with ANDRITZ technology

Since August 2017, the main technologies and production equipment provided by ANDRITZ for Fibria's new pulp mill in Três Lagoas (MS) Brazil, are in operation. The works were started up in advance of the schedule.

As a result of investments of BRL 7,345 billion, the second Fibria plant in Três Lagoas will have a production capacity of 1.95 million tonnes of eucalyptus pulp per year. Adding to the first unit, already in operation in the city, the company now has a production capacity of 3.25 million tonnes of pulp / year, which makes Fibria's operation in Mato Grosso do Sul one of the largest pulp mills of the world. In total, considering all the other units of the company – Aracruz (ES), Jacareí (SP), and Eunápolis (BA), where Veracel operates – Fibria reaches a production capacity of 7.25 million tonnes of pulp / year, consolidating its global leadership in the sector. With this successful EPC delivery and smooth start-up of the equipment, ANDRITZ has once again demonstrated its technical capabilities and experience in handling very large projects.



The Horizonte 2 Project – that became the new Fibria unit – is one of the largest private investments in Brazil. ANDRITZ supplied the complete wood processing plant (four chipping lines), the world's largest single hardwood fiberline (6,120 adt/d), the pulp drying plant (dual 8 m wide drying machines), the largest evaporation plant in the Western Hemisphere, the largest recovery boiler in South America (8,250 tds/d), and the largest single-line white liquor plant (18,900 m³/d) with two lime kilns.

According to Joel Starepravo, ANDRITZ Project Director, "Fibria signed the contract in July 2015 with start-up scheduled for fourth quarter of 2017. We met that fast-track schedule together. One thing we learned from previous large projects is that the first 100 days are critical – getting started on the right things at the right speed. We focused on making sure that our engineering was solid, that our subcontractors had the guidance they needed to work effectively, and that the manufacturing quality and schedule were solid."

PROJECT START-UPS

COMPLETE LINES AND SYSTEMS

ANDRITZ, Graz, Austria
PrimeLine TIAC – Tissue Innovation and Application Center
Unique tissue innovation center

Fibria, Três Lagoas, Brazil
Complete pulp mill installation, EPC delivery
Complete pulp mill in time and budget

Guizhou Chitianhua Paper Industry
Chishui city, Guizhou province, China
TM5 and TM6: PrimeLineST W20, incl. stock preparation
Biggest steel Yankee manufactured in China so far with 20ft diameter

Heinzel Group, Laakirchen, Austria
Paper machine rebuild, incl. stock preparation and complete automation package

Metsä Group, Äänekoski, Finland
Complete wood processing, flexible softwood/ hardwood fiberline, evaporation plant, and recausticizing plant
New bioproduct mill

Vinda Paper (Zhejiang), Longyou Industrial Zone, Zhejiang province, China
Stock preparation line

EQUIPMENT/UPGRADES

Carmeuse, Clear Brook, Virginia, USA
Vertical kilns
Installed supplemental burners system on a vertical kiln

Carmeuse, Saginaw, Alabama, USA
Horizontal kilns and material handling equipment
Replace existing Modicon PLC systems with Rockwell Control Logix

Haile Gold., Kershaw, SC, USA
Schneider Quantum PLC system with Wonderware

Weyerhaeuser, Columbia Falls, USA
MDF refining lines
Replace Rockwell PLC5 system with Rockwell Control Logix's

ANDRITZ SUCCESSFULLY STARTS UP REBUILT PAPER MACHINE for Heinzl Group in Laakirchen, Austria

The rebuilt PM10 at Laakirchen has been successfully started-up. The machine that originally produced SC paper was converted to a fluting and testliner machine producing basis weights ranging from 70 to 140 g/m² based on recycled fibers.

With a design speed of 1,600 m/min and a working width of 7,500 mm, it is now one of the world's most productive paper machines for fluting and testliners.

"We have implemented a comprehensive investment package for our paper mill in Laakirchen. The heart of this package is the PM10 rebuild. The new ANDRITZ technology enables production at the highest quality level. In addition to our PM11, which will continue producing paper for the high-quality SC market, the PM10 produces 450,000 t/y of fluting and testliners," says Thomas Welt, Production Director at Laakirchen Papier AG.

This order once again confirms the strong business relationship between ANDRITZ and the Heinzl Group. ANDRITZ has already

started up Europe's largest new MG paper machine (PM2) successfully at the Pöls mill as well as a new black liquor recovery boiler plant.

Read about the full scope ANDRITZ supplied for this project at: www.andritz.com/spectrum/news-laakirchen



DID YOU KNOW THAT...



... ANDRITZ operates a fully equipped stock preparation pilot plant at its headquarters in Graz, Austria?

Papermakers have the possibility to test their ideas on a pilot scale and simulate exact paper mill conditions – whether on a single piece of equipment or a complete line with complex setups. At the stock preparation pilot plant, all kinds of raw materials can be processed with small industrial-scale units as opposed to using laboratory-scale equipment. Find out what “Trial and no error in stock preparation” means to ANDRITZ and see the new video!

Get more information at:

www.andritz.com/stockpreparation



... ANDRITZ just celebrated its 10-year anniversary of screen basket production in China?

More than 6,000 screen baskets have been manufactured since production began in Foshan, China 10 years ago! Producing mainly for the domestic market, more than 30 employees work in the areas of manufacturing, sales, service, and administration in the screening division in China.

Get more information about ANDRITZ screen baskets at:

www.andritz.com/pp-screening



... ANDRITZ offers customized solutions for solving vibration issues on machines, regardless of the OEM or type of machine?

In every mill the most important topics are safety and highest energy efficiency, while maintaining the best possible fiber quality. Vibration issues can have an impact on both of these topics and significantly reduce the availability of the machines.

Get more information about vibration analysis at:

www.andritz.com/vibrationanalysis

ANDRITZ