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TISSUE DREAMS

Zhang Qun Fu, General Manager, sees a bright future for the Hengan Group (Page 16)

ANDRITZ
Pulp & Paper

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Is **innovation** possible in a **mature** industry?

It has been said that Pulp & Paper is a “mature” industry, which is generally meant to imply that our best days are behind us and there is no room for new ideas or new growth.

As mature adults ourselves, we take exception to this. While most of us are not jumping out of helium balloons 24 miles above the earth’s surface like our fellow Austrian, Felix Baumgartner, that doesn’t mean we are sitting in rocking chairs watching the days pass by. We are alive. We are energized. We are taking risks. We are creating a future. And yes, we are innovating.

“Innovation is the act of executing new ideas to create value.”

Value creation is something that mature industries can do well. Mature leaders have the perspective to inspire the creation of ideas, the experience to select ideas, and the knowledge to prove the value of these innovations.

Creating value

ANDRITZ will not grow by offering the same products to the same customers at the same prices. Eventually, someone will reverse-engineer our technology, without doing any of their own R&D, and sell it cheaper. So we have to stay one step ahead.

Step-by-step improvements are still innovative. They create value. These incremental improvements are particularly important for the Pulp & Paper industry, which is not exactly known for its risk tolerance.

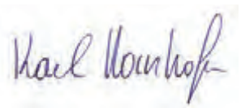
The needs of a “mature” industry

Our innovations support our strategy of supplying complete production lines and comprehensive services. Step-by-step innovations increase the throughput, speed up project execution, synchronize capacity increases to avoid bottlenecks, and lower the overall lifecycle cost of a production line. As a result, the return on invested capital is substantially higher than equipment purchased piecemeal.

Sustaining the future

ANDRITZ is committed to further innovating the chemical, mechanical, and recycled fiber processes. In this issue of Spectrum are recent examples of value creation: an innovative pre-hydrolysis technology for the preparation of dissolving pulp (page 6); enhanced services (pages 14 and 32); energy recovery technologies (page 16); green energy developments based on biomass (pages 22 and 40); and modern technology for recycled fiber (page 36). As your technology partner, our role will continue to be to make your business more productive, more sustainable, and more profitable.

◀ Karl Hornhofer (standing) and Humbert Köfler.



Karl Hornhofer
Member of the Executive Board
PULP & PAPER – Capital Systems

Humbert Köfler
Member of the Executive Board
PULP & PAPER – Service and Units

NEWS

Out with the old – **in with the new**

Sappi Southern Africa's Ngodwana Mill is in the midst of a project that will add 210,000 t/a of specialized cellulose production at the mill. ANDRITZ was selected to rebuild the pulp drying plant for Project GoCell, which began in mid-2012 and is being fast-tracked for completion this year.

ANDRITZ modified the existing dewatering machine's wet end and installed a new shoe press. A new baling/finishing line will also be part of the scope. But the most interesting challenge was how to remove the old pulp dryer and replace it with a new ANDRITZ airborne sheet dryer in the existing building.

ANDRITZ engineered a solution to remove the old Ross dryer intact, roll it out of the building, and roll in the new ANDRITZ dryer which was erected outside the building. Though it was a tight fit, the new dryer is in place and the line has started up.

A "smart" press for sludge dewatering

Smart Automobile's micro-cars from Daimler AG have proven quite popular. ANDRITZ now has created its own "smart" design to meet the market requirement for smaller sludge dewatering units. The new SCS454 screw press is not just the result of scaling everything down (it has a diameter of 450 mm and is four meters long compared to its "biggest sister" at 1,400 mm diameter and eight meters long), it involved some smart re-thinking of the basic design. For example, the stock outlet is on the gearbox side of the shaft, allowing for better distribution of the high torque forces into the machine. The SCS454 has all the features of the well-proven, bigger machines, but is perfect for smaller tonnages.

Transplanting the heart

With the delivery of the "heart" of the new ANDRITZ machine at Zellstoff Pöls AG in Austria, Europe's largest kraft paper machine, work is proceeding on schedule. The "heart" is a 22 ft. diameter *Prime*Dry Steel Yankee drying cylinder – the world's largest. The Yankee was transported from ANDRITZ's Graz workshop in March in two pieces because of its giant size. It is being assembled on-site and will be lifted into the machine room in June. The new machine is scheduled to be operational at the end of 2013. Total weight of the Yankee, which is constructed entirely of steel, is 150 t. The steel construction gives higher performance, enhanced safety, and energy savings, compared to cast cylinder technology.

Highlights of **new orders**

COMPLETE LINES AND SYSTEMS

Mondi Dynäs
Väja, Sweden
LimeKiln with LimeFlash technology.

Mondi SCP
Ružomberok, Slovakia
High Energy Recovery Boiler and evaporation plant retrofit.
Will be one of the most efficient recovery boilers in the world in terms of its power-to-heat ratio.

Växjö Energi
Växjö, Sweden
Biomass BFB boiler.

Fortum Värme
Stockholm, Sweden
Biomass CFB boiler incl. flue gas cleaning plant, electrification, and control systems.
This plant will be one of the largest of its kind in the world.

Siam Kraft Industry
Ratchaburi, Thailand
OCC and reject handling systems
First OCC line with drum pulping (1,200 t/d) in Thailand – based on 100% LOCC (Local Old Corrugated Containers) with reject handling.

COMPLETE LINES AND SYSTEMS

Naberezhnye Chelny Paper Mill
Tatarstan, Russia
Rebuild wet and press section incl. stock preparation and approach flow systems.

Kartonsan Karton Sanayi ve Ticaret A.S.
Izmit, Turkey
Upgrade of board machine; upgrade of stock preparation, machine approach, and broke systems.
Increase capacity for duplex and triplex board by 60%.

Shangdong Sun Paper China
Shangdong, China
Two tissue machines for production of high quality facial and toilet paper.
Includes PrimeFlow two-layer headbox including dilution control, 18 ft. diameter PrimeDry Steel Yankee, PrimeDry ReEvaporation HeatRecovery system, stock preparation plant, and automation systems.

KEY EQUIPMENT, UPGRADES, AND MODERNIZATIONS

China CAMC Engineering Hong Kong
Svetlogorsk, Belarus
Pre-Hydrolysis Vessel for production of viscose pulp.

Södra Cell Mönsterås
Mönsterås, Sweden
Two PowerFeed de-icing conveyors for the woodyard.

Celulosas de Asturias
Navia, Spain
Evaporator retrofit and CNCG incineration system.

Quesnel River Pulp
Quesnel, B.C., Canada
Low consistency refining package.
Replacement of HC secondary and reject refining with TwinFlo LC refining.

Reno De Medici
Santa Giustina, Italy
Equipment and services for a machine approach system.

Highlights of **new start-ups**

COMPLETE LINES AND SYSTEMS

RIGESA Celulose Papel e Embalagens
Três Barras, Brazil
Fiberline modernization (brownstock washing, screening, and refining).

Iggesund Paperboard Workington
Workington, United Kingdom
EPC delivery of biomass power boiler incl. biomass handling, fuel feeding, and auxiliaries.

Stora Enso Poland
Ostroleka, Poland
Recycled fiberline and reject treatment system
1,665 t/d OCC line with advanced reject treatment.

COMPLETE LINES AND SYSTEMS

Smurfit Kappa Hoya
Hoya, Germany
Rebuild PM2 dryer section
Rebuild included new PrimeRun web stabilization system, ropeless tail threading system, film press, and energy-recovery hood.

A.Merati
Cartiere di Laveno, Italy
Rebuild of board machine wet end
Rebuild included widening of the complete wet section, containing the PrimeForm Fourdrinier former and PrimePress X shoe press section.

Nanning Phoenix
Guangxi, China
*Prime*Line high-speed tissue machine and stock preparation plant
Included PrimeDry Steel Yankee high-precision drying cylinder.

KEY EQUIPMENT, UPGRADES, AND MODERNIZATIONS

Phoenix Pulp and Paper Public
Amphur Nampong, Khon Kaen, Thailand
Stacker reclaimer system for woodyard.

C&S Paper Jiangmen
Jiangmen, China
Pulper, refiners, deflakers, disc filters, and screens.

Nine Dragon Paper Industries
Chongqing, China
Pulpers and refiners.

Vinda Paper
Xiaogan, China
Pulpers, cleaning plant, screens, disc filter, refiners, and fan pump.

Textile pulp: another bright moment for Sun Paper

Supplying China's clothing producers with a natural fiber alternative.

In November 2011, Sun Paper entered an entirely new business at its pulp mill in Yanzhou, Shandong Province, China. Sun became a producer of dissolving pulp made from local poplar at a capacity of 200,000 t/a.

Dissolving pulp has a very high cellulose content (> 92-97% compared to 85-90% for kraft pulp), making it suitable for the production of rayon, acetate textile fibers, filters, etc. The pulp gets its name from the fact that the cellulose fiber is dissolved in a caustic solution to form viscose, which is extruded through spinners to form rayon filaments.

Declining global production of cotton in 2009, and the corresponding high prices, opened the door for dissolving pulp producers. In 2011, China's dissolving pulp capacity reached 896,000 tonnes, of which roughly 70% was newly added.

Modest investment

According to Sun Paper's management team, the leap into "textile" pulp required a surprisingly modest investment to convert the 300,000 t/a bleached hardwood kraft line.

"By adding an ANDRITZ pre-hydrolysis tower next to our existing continuous digester, and an extra bleaching stage with a wash press, we basically converted from paper pulp to dissolving pulp," says Ying Guangdong, Vice President and Technical Director of Sun Paper. "We were the first to install this new technology, but it was a calculated risk. Given our long partnership with ANDRITZ, we were certain that the investment would pay off."

Similar, but different

The production processes for dissolving pulp and paper pulp are quite similar, and both use wood chips as the raw material. But for the production of dissolving pulp, a pre-treatment step is added to remove most of the hemicelluloses in the wood.

According to Hannu Råmark, Director of Technology for ANDRITZ's Fiber Technology Division, "The emphasis today is on modifying existing lines so they can 'swing' production to either paper pulp or dissolving pulp depending on market conditions. This type of project fits right into an ANDRITZ strength."

ANDRITZ technology for the production of dissolving pulp is based on many years of experience with chemical pulp fiberlines and intensive R&D in the area of hemicellulose removal. "Many of our existing process technologies are suitable for dissolving pulp production," Råmark says. "By planning for this in advance, with careful consideration in the piping design and materials of construction for example, a mill can switch pulp grades to take advantage of market pricing."

◀ Ying (left) and Chen Jieyu, ANDRITZ Project Manager, inspect a textile sample made from Sun Paper dissolving pulp.

"It is bold to be the first to try a new technology. But being bold often yields the highest results."

Ying Guangdong,
Vice President and Technical Director,
Sun Paper

Clouds removed

Notes Liu Yan Bo, Pulping Production Manager for Sun Paper, "With any new technology there are bound to be challenges. Soon after start-up, we faced some production problems with the continuous pre-hydrolysis. After some adjustments, and good support from ANDRITZ, the benefits of producing textile pulp have already proven to be significant."

According to Ying, "We trust ANDRITZ because they understand our needs to produce quality pulp and paper. They are also willing to educate us about running this new technology. They organized a special R&D seminar just for us with the Helsinki University. In addition, we have been doing research and trials at their lab in Glens Falls, New York (USA), both before and after the conversion."

Adds Liu, "Our continuous process for dissolving textile pulp started up very quickly, and has maintained high yield and productivity ever since. Our textile pulps are considered the best by leading textile producers. "We have good cooperation with ANDRITZ and very good results. The frequent exchange of ideas is helpful to both companies."

◀ The ANDRITZ PHV (Pre-Hydrolysis Vessel) is a new technology developed for hemicellulose removal with continuous cooking. The world's first PHV was delivered to Sun Paper and is shown here next to the existing continuous cooking system. The mill has the flexibility to swing production between dissolving and traditional kraft pulp.

The Wash Press (AWP) represents ANDRITZ's first delivery to China. The compact unit was originally ordered to provide additional brownstock washing capacity, but was moved to perform P-stage bleach washing in the dissolving pulp process. It removes a range of contaminants to achieve the quality standard necessary for textile pulp producers. Liu points out that the value of the wash press cannot be underestimated. "The purity of the pulp gained from this compact unit assures a quality level not otherwise possible," he says. "Our customers require exceptional cleanliness."

"The benefits of producing textile pulp have already proven to be significant."

Liu Yan Bo,
Pulping Production Manager,
Sun Paper

Forget about batch

"Batch has been the tradition with viscose pulps," says Chen Jieyu, ANDRITZ Project Manager. "But, the batch process is expensive to run. Sun Paper recognized the benefits of a continuous process and had the confidence in us to make it happen."

"Everything in this line is controlled by a DCS, so very little operator attention is required," Ying says. "Running our dissolving pulp line is almost as easy as taking photos with a quality digital camera. By contrast, the batch process depends too much on the chef. You can have a gourmet meal, or something terrible. When you consider the value of a continuous process, highly automated where quality is constant, it is an easy decision."

Removing hemicellulose the continuous way

The key to dissolving pulp production is efficient removal and recovery of hemicellulose from the fiber source. Otherwise, the hemicelluloses will precipitate during the rayon production process, plugging up the filament spinners. The spinners convert the pure cellulose into yarn, looking much like cotton once it is processed.

According to Aaron Leavitt, Principal Engineer for cooking technology at ANDRITZ, "Stable production was a problem with older technologies. All that changed with the introduction of the Pre-Hydrolysis Vessel (PHV)."

The ANDRITZ PHV is a new technology developed for hemicellulose removal with continuous cooking. "We redesigned the cooking process to include auto-hydrolysis for efficient hemicellulose removal," Leavitt explains. "The PHV can be installed in a new line, and is easily applied to existing installations, such as at Sun Paper."

Based on initial findings, installation and operational costs with the PHV are lower than with the traditional, batch-based dissolving pulp process. "The pulp quality is better than with existing batch technologies," Chen says. "This is due to better selectivity of the hydrolysis reactions and a controlled, sustainable recovery of the hemicellulose by-products."

◀ The ANDRITZ Wash Press (AWP) is the first in China. The compact unit performs P-stage bleach washing in the dissolving pulp process.

Seizing a market opportunity

The dissolving pulp market in China has experienced a boom in recent years, both because of the strong textiles manufacturing base, and a governmental shift away from supporting cotton. The government, highly aware of the need to feed 1.4 billion people, has chosen to encourage more planting of food crops, such as rice and corn. Combined with the emergence of poplar tree plantations owned by Sun Paper and local farmers, the company was ideally positioned to gain from this hardwood fiber for textile production.

Explains Ying, "Because of a fast start-up, we were able to take advantage of the spike in prices. Even now, we are profitable with the current pricing. When prices go up again, we will do even better."

Flexibility can be sweet

The best measure of the value of Sun Paper's textile pulp is acceptance by consumers. "We are hearing from producers that our textile pulp has qualities that consumers want," Ying says. "In addition to excellent moisture absorption, the smooth, soft surface allows fabrics to drape in a way that flatters the figure. We are told that our pulp is good for sensitive skin. In addition, the process employed to turn our pulp into yarn is considered to be environmentally friendly."

◀ Chen Jieyu of ANDRITZ (left) with An Qingchen of Sun Paper in front of the ANDRITZ MVR evaporators which considerably reduce fresh water consumption in the mechanical pulping lines. Sun Paper is leading the world with its zero discharge accomplishments at this mill.

Says Liu, "We did a lot of research before converting our line to textile pulp. We realized that customers wanted more than cotton replacement. They wanted properties that made end products better, and sometimes cheaper. Our fiber comes from nature, but can behave in different, desired ways compared to cotton. It can be shorter, or longer, providing our customers' customers with a new range of options."

A key criteria for Sun Paper's choice of the ANDRITZ dissolving pulp production technology was the ability to swing the system back to bleached kraft production when they choose. Says Ying, "Flexibility is always wise, because markets fluctuate. We have a strategic advantage to shift production. Another bonus is that our textile pulp investment opens the way for other value streams from the byproducts. The hemicellulose extracted during pre-hydrolysis can be used to produce xyclose for chewing gum. And, if the quality of the hemicellulose is not sufficient for this, we mix it with the black liquor as a fuel for the recovery boiler."

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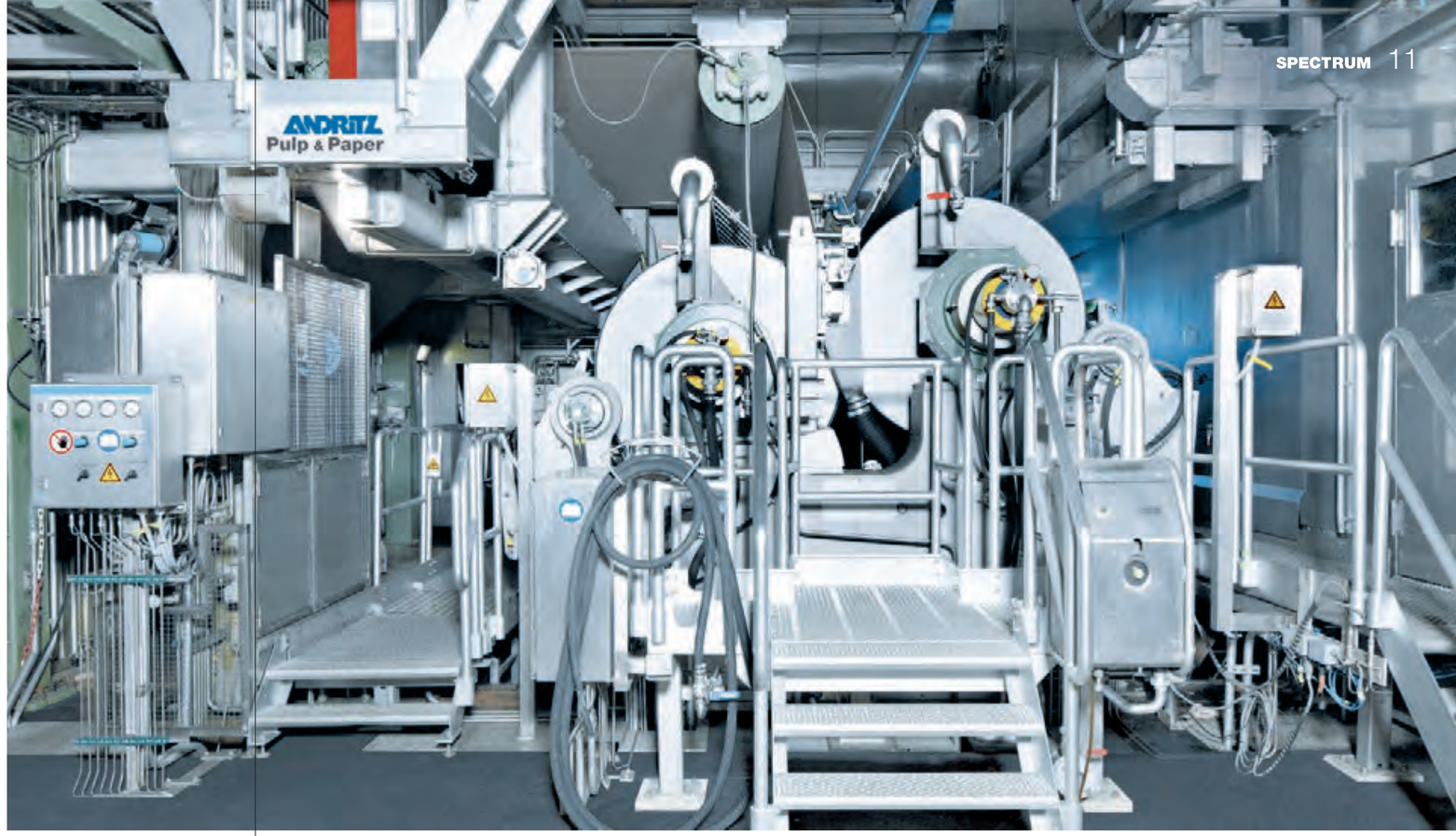
A long partnership with ANDRITZ

Significant pulp production at Sun Paper comes from their four ANDRITZ P-RC APMP mechanical pulp lines (first one started up in 2008) which produce 700,000 t/a. All the mechanical lines employ ANDRITZ Zedivap system to eliminate normal effluent treatment by utilizing mechanical vapor recompression (MVR) technology to remove most of the water from the effluent. Condensate is returned to the APMP process, reducing considerably fresh water consumption. Residuals are further concentrated and incinerated.

According to An Qingchen, Sun Paper's Project Manager for the APMP mechanical pulp lines and evaporation systems at Sun Paper, "Sun Paper is leading the world with its zero discharge accomplishments here. We enjoy the challenge of leadership in environmental performance."

Two other recent projects include the installation of ANDRITZ biomass handling equipment for the power generation plant (September 2011) and an ANDRITZ LimeKiln, started up in December, 2012.



Combination film/size press installed at Hamburger Pitten. ▶

Just the 2 of us

For Hamburger Containerboard in Austria, ANDRITZ converted the machine's old size press into a new design combination film/size press to accommodate different grades of packaging paper. The new press allows machine operators to switch between film-mode or size-mode in less than two minutes. Remarkably, the switch can occur "on the fly" without having to stop the machine.

Hamburger Containerboard is a leading producer of high-quality containerboard in Europe, with an annual capacity of about 1.6 million tonnes of packaging papers. One of its mills is situated in Pitten (Austria), a location with a tradition of 150 years of papermaking expertise.

PM4 in Pitten was put into service in 1978 and has been rebuilt several times. With the last rebuild in 2004, PM4 increased production to 865 t/d of testliner and fluting (100 to 230 gsm). PM4 has a trim of 5.1 m and a top speed of 1,100 m/min. The weak point in the machine after the rebuild was the size press, which had reached the end of its useful life after being in operation nearly 25 years.

"We were noticing very high specific steam consumption in the size press," says Gerald Steiner, Production Manager at the mill. "We could see corrosion on the frame and we noticed vibration at high speeds and low grammage. Roll covers had a very short life of two to three months. It was time for replacement."

Two-phases of project

Steiner and his team began the process of evaluating suppliers for the rebuild of PM4. In their minds, the project had four major targets: energy, starch, quality, and safety. According to Steiner, "On the economic side, our aim was to lower our energy costs and decrease the consumption of expensive starch. On the operational side, we wanted to improve the sheet quality and make the machine safer to operate for our people."

The catching point was how to swiftly and efficiently apply starch to the different basis weight sheets. For paper with a basis weight of more than 170 gsm, Hamburger wanted to use a size press (maximum 11% starch). For other grammages and products, the mill preferred the benefits of a film press (maximum 18% starch). This would allow the mill to reduce the energy required to dry the sheet and increase the speed of production for a lighter sheet in the future.

The best of both worlds

In a typical machine, the size press applies a solution of starch or other material onto the surface of relatively dry paper (in a vat or pond), after which the paper is dried to final moisture content. The starch increases the surface strength of the paper and can also reduce dusting tendencies, increase stiffness, and reduce air-permeability.

Because the surface of the sheet is re-wetted in a size press, there is an increased possibility that the web will break. The likelihood of web breakage is considerably greater if the size press is of the traditional "flood" type, in which the sizing is applied by passing the paper web through a vat of starch solution.

This is where the film press comes in. The film press applies a precise amount of starch on a press roll, which is then transferred to the paper sheet. More starch can be applied with less water, so the after-drying is more energy-efficient.

"We had the desire to have both press technologies available to us on the same machine and within our space requirements," Steiner says. "We asked several suppliers for a proposal on how they would accomplish this."

Faced with this challenge, ANDRITZ engineers looked at their traditional technology in a new way. "Our target was to efficiently combine the size press and film press in the same basic unit and make it an economically attractive solution," explained Altay Koc, Technical Manager at ANDRITZ.

> *"On the economic side, our aim was to lower our energy costs and decrease the consumption of expensive starch. On the operational side, we wanted to improve the sheet quality and make the machine safer to operate for our people."*
>
> Gerald Steiner,
> Production Manager,
> Hamburger Containerboard

“Our target was to efficiently combine the size press and film press in the same basic unit and make an economically attractive solution.”

Altay Koc, Technical Manager, ANDRITZ

“There are a certain number of unknowns until you actually get in there and dismantle the machinery to see what condition it is in.”

Klaus Aengenendt, Project Manager, ANDRITZ

“We did not have much experience with ANDRITZ in the past, but their concept was sound and we were convinced they could do it,” Steiner says. “They were flexible and willing to regard our wishes even in the details. This made it easy to come to the decision and sign the contract.”

Combination *Prime*Coat Film/ *Prime*Coat Size

“There are not many combination size/film presses operating in the world,” says Koc. “While this is a limitation in terms of experience, it also removes the limitation of being confined by what is considered an industry standard. We were free to take a fresh look.”

Within nine months, the ANDRITZ team designed and built its first combination press – joining the technologies of the *Prime*Coat Film and *Prime*Coat Size into one compact unit.

“It is certainly not the first combined prime press in the world,” Steiner of Hamburger Pitten says. “But there are only a few of them in the world, and none with the exact capabilities we were asking for.”

Two phases to project

The work at Pitten was done in two phases. In August of 2011, Pitten installed a ropeless threading system and other modifications on the machine.

In January 2012, ANDRITZ installed a combined film and size press with a *Prime*Air Glide. Pitten also installed a quality control system for measuring moisture prior to the new press. The work in January required an outage of only 11 days.

Machine rebuilds are always a challenge. Just ask Klaus Aengenendt, Project Manager for ANDRITZ. “There are a certain number of unknowns until you actually get in there and dismantle the machinery to see what condition it is in,” he says. In the case of PM4, some extra work was required due to the framing corrosion.

Machine downtime was less than two weeks. “Reaching this result required hard work and great cooperation on both sides,” says Aengenendt. “We all learned a lot from each other,” Steiner agrees. “It was a very good partnership and communications were clear. We certainly are not ones to be easily satisfied and to always accept the first answer. We need to see solid actions and performance results.”

Combined results

With the new combination press, Hamburger has more flexibility in production planning for PM4 and in operating the machine. It is possible to mix the two modes: using the film press for the top side and the size press for the bottom size, for example.

“We are very satisfied with the new film/size press,” Steiner says. “We now have the maximum of flexibility in production, higher speeds, and higher quality. Maintenance accessibility is also pretty good.”

As we all know, even the most meticulous planning and test results in pilot trials can lead to surprises in results from real-life installations. But, in the case of PM4, the surprises were all good.

“When we began to operate the rebuilt machine, we tested the limits of the film press mode,” Steiner says. “To our surprise, the film press actually performs perfectly with heavy testliner up to 230 gsm. This means we can cover our whole product range with the film press. This saves us energy in the drying section due to the higher starch application. Of course, our operators don’t get the fun of switching modes ‘on the fly’ but the economics are important.”

The film press mode significantly reduces starch consumption compared to the old pond-style size press. “The strength values of the sheet are all within specifications after the rebuild and we have been able to reduce dryer steam pressure by two to three bar,” Steiner says. “The energy savings alone is about 10%.”

When doing the ROI calculations at the feasibility phase of the project, Hamburger Pitten arrived at an estimated three-year payback, but has realized another pleasant surprise. “We are now seeing that the payback period is significantly shorter than what we estimated,” Steiner says. “Those are the kind of surprises we love to have!”

The new press brings some other notable enhancements. It avoids the waste of starch due to incomplete closure of the nip, which creates sediment in the pond. This sediment can be a major cause of web breaks. Steiner also likes the addition of a new *Prime*Air Glide system with air turn to turn the web on a cushion of air, with a consistent ride height regardless of the web tension.

“We are looking forward to the next project and would certainly consider ANDRITZ again,” Steiner says. “They intrigued us with their initial concept, and convinced us with their project performance, technical expertise, and ongoing support.”

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◀ 3D graphic of the ANDRITZ film press.

First hand knowledge of Second Hand Solutions

Not every mill has the budget or the need for new equipment. ANDRITZ now offers a service that reduces the risk of owning Second Hand equipment.

▲ ANDRITZ has developed detailed procedures for relocating paper machines and has the capability to modernize or upgrade the machine before reinstalling it.

"ANDRITZ is well-known as a supplier of new technology. It is perhaps not so well-known that we broker, recondition, and install second hand equipment, even complete plants," says Karl Eickhoff, Senior Vice President of the new Second Hand Solutions organization. "We handle equipment from all manufacturers, not just ANDRITZ."

Eickhoff is joined by Guido Senger, Project Manager for single machines, and Andreas Schmidt, Project Manager for plant transfers. Between the three of them, they offer compelling evidence for ANDRITZ's entry into this business area.

Single machines – global inventory

"With 160+ years' experience designing machinery, our tendency was to think 'new' all the time," Guido Senger says. "But we have many customers asking us to help them locate used equipment – or to combine new and used in our process design."

This led to the formation of the Second Hand Solutions team. "ANDRITZ people are in mills every day of the year," Senger says. "This network is helping us build a global database of used equipment. Our strength is having knowledge of the idle equipment that is in every mill – equipment that mills want to sell if they knew how to find buyers."

More than a broker

"If a customer simply wants the equipment as-is, we operate as any other broker does," Senger says. "We compete at the same market prices."

But the benefit of ANDRITZ's approach is in adding the full knowledge and backing of a technology company, which reduces the risks for customers buying used equipment. "Many customers don't want as is equipment." Senger says. "They want us to return the machine to good mechanical condition. And if a customer asks us to provide technical and service support, for example supervision in reconditioning or help in installing the equipment, we are happy to support a customer at any desired level."

"We handle second hand equipment from all manufacturers, not just ANDRITZ."

Karl Eickhoff,
Senior Vice President of
Second Hand Solutions, ANDRITZ

◀ Part of the Second Hand team (from left to right): Guido Senger, Project Manager; Christian Lang, Head of Repair Center; Karl Eickhoff, Senior Vice President; Mario Menapace, Project Manager; Julia Achatschitz, Controller; and Andreas Schmidt, Project Manager.

The expertise in equipment design and process technology gives ANDRITZ a big advantage in the used equipment market. Specialists know the wear-points and potential a piece of equipment has – allowing them to give good advice to customers.

"The advantage of purchasing as is equipment is the price," Senger says. "The disadvantage is the lack of technology expertise and technical support, which increases the risk. With us, customers can get as is at market prices, refurbished at market prices, and expert support for peace of mind at competitive prices. What's not to like?"

Plant transfers require practical, precise planning

"We offer single machines up to complete plants on a second-hand basis," says Andreas Schmidt. "Take, for example, a paper machine. The challenge is to have detailed procedures for relocating a machine and all its auxiliaries from here to there while keeping most of the equipment in a reusable state."

Schmidt explains that a traditional erection company might be okay at the take-a-machine-from-here-to-there assignment, but would fail miserably at the take-a-machine-from-here-modify-it-then-install-it-there-in-an-intelligent-way assignment.

"Typically, a contractor will dismantle a machine, put it in boxes, and ship it," Schmidt says. "They try to minimize their time, and don't care to do this in an intelligent way by preserving the complex piping connections, valves, instruments, or whatever. Our approach is to preserve and reuse all materials as much as possible. Not only does this save the customer money, but it also saves engineering and installation time."

And time, according to Schmidt, has become a very serious consideration. "There was a time when you would dismantle a machine in the north, ship it by slow boat south, and install it over a two-to-three year time frame," he says. "Today everything is done under very tight time constraints that require sophisticated logistics in dismantling, engineering, overhaul, installation, and commissioning. Simple erection companies cannot accommodate this."

It has been ANDRITZ's experience that 99% of the time, a customer will want more than just a simple machine relocation. "Customers are upgrading or modifying the machines before restarting them," Schmidt says. "This means access to expert machine design and automation specialists, which is an ANDRITZ strength."

Both Schmidt and Eickhoff think that ANDRITZ is unique in having developed detailed procedures for the complete process of relocating machines quickly and efficiently – including the re-engineering and process design so that the machine fulfills new requirements in its new home.

"It will be a state-of-the-art machine in terms of system design, process design, and controls," Schmidt says. "It will just be made up from older steel."

Key benefits of Second Hand Solutions:

- Global network to locate used equipment
- Online database of equipment for sale
- Expertise to recondition/upgrade equipment
- Technical support and on-site supervision when needed
- Considerable financial strength to broker the best deals

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Hengan dreams **of tissue**

Local entrepreneurs from Fujian Province have achieved a 20% market share of premium tissue for the Chinese market since launching the company in 1985. Aiming for two million tonnes per year production by 2020, the Hengan Group China remains passionate about brand leadership. From its first machine and into the future, ANDRITZ is their leading machine supplier.

The dream to produce quality tissue grades in China started very simply, but with boldness for Hengan. The basic idea was to produce higher quality tissue and hygiene products for Chinese consumers than they were getting from local producers.

Xu Lian Jie, CEO, and his management team, decided to build a state-of-the-art mill at Changde, Hunan Province, starting with 30,000 t/a production. In addition to proving the "quality" concept, the new company needed to establish distribution channels for new brands.

"Our aim was that the first time anyone tried a Hengan tissue product – a mother, a hotel purchasing agent, or a supermarket manager—they would feel and sense the quality," Xu says. The company knew that loyalty would be built upon a very personal connection.

According to Xu, Hengan has over 15,000 account managers and sales people working in about 800,000 stores across the country. As he puts it, "Our people believe in our products, and express their confidence to consumers." Supported by extensive in-store marketing, creative packaging, and media advertising, Hengan is a force in the marketplace. In only 15 years, it has become widely recognized, and is strategically focused to maintain that position.

Says Xu, "We are adding a lot of capacity to secure our place as the number one tissue producer for the long term."

Pioneering Hengan

The Hengan way of running a tissue company also required a wise selection of business partners: ranging from procurement of pulp and consumables to the production and converting technology. Of great importance to Hengan management was the selection of the tissue machine itself.

▲ ANDRITZ Double Disc TwinFlo Refiner for optimum fiber development.

▲ ANDRITZ process pumps and agitators.

▲ *Prime*LineTM tissue machine. In 2012 alone, four 50,000 t/a ANDRITZ machines started up at Hengan's Chongqing and Jinjiang mills. Four additional machines are on order.

▲ *Prime*Dry ReEvaporation system for energy savings.

▲ Parent rolls are converted to premium tissue products on-site.

▲ Hengan has achieved a 20% market share of premium tissue for the Chinese market since launching the company in 1985.

◀ Li Xinjiu, Hengan General Manager for Papermaking (left), and Bai Bingchen, ANDRITZ China's Vice General Manager for Tissue, at the new machine in Jinjiang.

> *"Making the best tissue starts with the best equipment."*
>
> Zhang Qun Fu,
> General Manager,
> Hengan

▲ Zhang Qun Fu, Hengan General Manager (left) and Klaus Gissing, ANDRITZ Vice President for Tissue and Air Engineering, discuss the new machine's performance.

"ANDRITZ has been critical to our tissue strategy," says Zhang Qun Fu, Hengan General Manager. Zhang oversees the company's technical design, layout, and construction. "Making the best tissue starts with the best equipment. "When we first talked with ANDRITZ, they were like us in the Chinese tissue business. They had something to offer, but were not yet established."

Zhang likens Hengan's progress to that of moving from infancy to adulthood. "From our birth to becoming an adult, continuous advances in technology have kept pace with our goal of delivering products that our customers desire. From our first project together with ANDRITZ in 1998, we have succeeded as partners and have grown dramatically."

ANDRITZ is the preferred supplier of the stock prep and tissue machine technology, having built a strong reputation since the start-up of the first *Prime*Line machine in 1998. In 2012 alone, four 60,000 t/a ANDRITZ machines started up at Chongqing and Jinjiang. Four more machines are on order for start-up in 2014.

From zero to two million

Before 1998, Hengan produced no tissue. By 2012, it led the Chinese market with a 20% share – producing 1.2 million t/a of high quality products. The forecast is for two million tonnes capacity by 2020. The pioneers who started Hengan boldly bet on their ability to meet the needs of China's growing increasingly urbanized society. And they exceeded expectations for growth and profitability.

Hengan has won loyalty for its brands, and respect throughout the industry for its distribution networks and quality of manufacturing. "I am proud to see China's rising quality with paper grades, and Hengan is leading the way," says Li Xinjiu, General Manager for Papermaking. "Hengan's first *Prime*Line machine set a new standard. World class quality, speed, and efficiency were the highlights. As the years have passed, our quality has gotten even better, and our operating costs are lower."

▲ Hengan's *Prime*LineTM machines are equipped with the latest resource-saving technologies: the *Prime*Dry Steel Yankee and the ReEvaporation system.

Steel outperforms

One of the advances in technology has been the *Prime*Dry Steel Yankee, which is now preferred on the Hengan machines.

It has become well-known that the *Prime*Dry Steel outperforms equally sized cast iron Yankees, especially when it comes to energy efficiency. The thermal conductivity of steel is similar to cast iron, but the wall thickness is thinner due to the high strength of the steel. This increases the amount of the heat transferred, up to about 20%.

Hengan's PMs 15 & 16 have, in fact, the world's largest *Prime*Dry Steel Yankees operating in tissue today. Sitting side-by-side at the Jinjiang mill, they produce tissue in about 1.4 seconds from headbox to the finished roll. The "twins" have Yankees of the same diameter (16 ft.) with shell lengths of 6.15 m. Two similar machines at Chongqing (PMs 11 & 12) as well as the four news orders (PMs 17, 18, 23, and 24) also have Steel Yankees.

Says Bai Bingchen, ANDRITZ China's Vice General Manager for Tissue, "The world's largest *Prime*Dry Steel Yankees for tissue are not about size just for the sake of size. They are a means to produce high volumes of quality grades at lower energy costs. Hengan is able to former a better sheet

and increase production at the same energy input. Or, the mills have the option to reduce energy consumption for a given production."

The right start for premium tissue

An area of ANDRITZ focus is the upstream processes to the machine itself. For every Hengan machine installation, ANDRITZ also delivered the complete stock preparation and machine approach systems.

The stock preparation system is designed for bleached virgin pulp with a conveying line, pulpers, protection screens, deflakers, refiners, S-series stock pumps, headbox screens, and FP-series fan pumps – all from ANDRITZ. In addition to stock preparation, ANDRITZ also delivered equipment for the broke line and the systems for water recirculation and fiber recovery.

Says Zhang, "Even though we use high-quality virgin pulp, which is much cleaner than recycled, we want our furnish to be extra clean. From the pulper to the machine chest, ANDRITZ helps us maintain a very high standard of furnish quality."

Heads above

All new Hengan tissue machines use *Prime*Flow headboxes, which use an eccentric shaft for slice adjustment to avoid what is known as slice deflection. In addition, the step diffusor turbulence generator, in combination with the nozzle geometry, deliver superior paper quality. An important feature of the *Prime*Flow headbox is a pentagonal/hexagonal outflow pattern of the turbulence generator. This creates a more perfect sheet.

Comments Bai, "The *Prime*Flow achieves a high level of consistency, or what we refer to as layer purity. When you make tissue at speeds close to 2,000 m/min, precision is a must."

Lower energy through heat recovery

According to Klaus Gissing, ANDRITZ's Vice President for Tissue and Air Engineering, "Hengan has proven to be an ideal partner for new technological developments. They are always ready to innovate and are not afraid to take calculated risks to improve quality and reduce costs. We should credit them for pushing us to set new records for steel Yankee performance, as well as the development of our ReEvaporation system, which saves a lot of energy."

Recovering waste heat and using it in the tissue making process (for example to evaporate condensate from machine) is highly desirable. That is exactly what happens with the world's first *Prime*Dry ReEvaporation systems which were installed at Hengan.

"The ReEvaporation system delivers a large part of the energy that used to go into the atmosphere back into the tissue machine by using waste heat to evaporate condensate," Gissing explains. "This condensate goes back as steam to the Yankee. Up to 30% of the steam demand for the drying process can be generated out of waste heat, depending on the location of the technology in the hood exhaust air flow."

The impetus for the development was that Hengan wanted greater energy efficiency, according to Gissing. "We had an idea for a product to achieve this," he says.

"Hengan has proven to be an ideal partner for new technological developments. They are always ready to innovate."

Klaus Gissing,
Vice President of Tissue and
Air Engineering, ANDRITZ

◀ Connected with customers. Bai Bingchen (left) and Klaus Gissing (center) of ANDRITZ meet at a local supermarket with Zhang Qun Fu of Hengan to see Hengan's products on the shelves.

▲ The heart of the Hengan machine: an 18 ft. diameter *Prime*Dry Steel Yankee.

"ReEvaporation is now installed on the new machines at Jinjiang and Chongqing. The benefits from machine to machine range from very good to great."

According to Zhang, "ReEvaporation helps reduce our consumption of gas, so it saves us money."

The next step: revved up ReEvaporation

Says Gissing, "Our first ReEvaporation systems proved to be valuable in capturing and re-using energy. Now we are thinking broader and bigger, using the tissue machine as a power generator itself. The next step is still on the drawing board, but we are close. Hengan's openness to pioneering is valuable for our own development. Innovation is in their blood."

True partners: Hengan and ANDRITZ

Zhang is quick to point out that not everything is about technology. "The engineers and technicians from ANDRITZ provide our team a lot of help," he says. "Faster start-ups and better optimization are achieved with our mutual cooperation and hard work. Every day we learn from their valuable observations, comments, and experience."

According to Bai, "Every start-up has small issues and challenges to overcome. For example, with PM16, there were some small problems with the steam and condensate system. As partners, Hengan and ANDRITZ found the root cause and solved the problems in very short order."

Future wrapped in tissue

Zhang states, "In the future, tissue making in China will be much more energy efficient. It is a must to be competitive, and to be a leading contributor for sustainable development. Chinese consumers are more aware of issues concerning factories, and they expect more. Our close ties to consumers demand a high level of commitment."

It can be assured that Hengan will always push for new solutions and new technologies. "Our first focus is on enhancing the consumer experience through advances in softness and strength," Zhang says. "Secondly, it means energy efficiency and environmental protection. We are considered a leader in China for sustainability. This is reflected in the way we run our mills and the high functionality of our machines – including less water and energy consumption."

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◀ (From left to right) Xu Shuishen, Hengan Chief Operating Officer, Xu Lian Jie, Hengan Chief Executive Officer, Klaus Gissing of ANDRITZ, and Bai Bingchen of ANDRITZ.

“Pellets are living things”

RWE AG, a large European energy supply company, built one of the world’s largest pellet production plants in the USA. ANDRITZ was a key supplier of the production technology for this 750,000 t/a plant. There are many process considerations involved in producing a high-quality pellet – as the material is organic and “alive.”

The state of Georgia has the largest forested area in the Southern USA, about 24 million acres. The managed forests feed pulpwood to several mills – and also to a very large pellet plant near Waycross, Georgia.

The pellets are a source of renewable fuel for power generation in Europe, and are also being sold to several industrial customers in North America, according to Ken Ciarletta, Commercial and Supply Chain Director for Georgia Biomass.

Ciarletta was Plant Manager when the facility was being built and started up. “Our target was to find a site where there would be enough virgin wood, growing as fast as possible, using sustainable forestry,” he says. “Georgia has the wood supply and also has the infrastructure to supply raw materials to the plant and to transport the pellets away.”

Whole-log mentality

“When designing a facility like this, it pays to have a ‘whole-log’ mentality,” Ciarletta says. “You need to think through what you are going to do with the logs, the bark, the chips and the dust.”

That is one of the reasons that ANDRITZ won such a large share of the project. ANDRITZ is a major player in supplying complete systems for wood processing and wood pelleting technology. The amount of CO_2 neutral fuel produced on equipment from ANDRITZ replaces almost three million tonnes of oil and gas per year.

ANDRITZ delivered the woodyard systems on an EPC basis. “We are in a very competitive region here when it comes to fiber procurement, and we use a large volume of wood (1.5 million t/a),” Ciarletta says. Tree-length logs are loaded into a PowerFeed conveyor and then the ANDRITZ debarking drum where the bark is removed. The bark is screened, shredded, and conveyed to the plant’s power boiler. Debarked logs are chipped in the HHQ-Chipper.

“They produce a mini-chip here,” says Bernard O’Connor, head of ANDRITZ’s North American wood processing organization, “which is ideal for their pellets. The chipper is set for an 11 mm long chip and we average about 2.4 mm thickness. This eliminates the need for green grinding, with its associated power consumption.”

“When we were building the plant, we thought that the woodyard would be the bottleneck, but it is not,” Ciarletta says. “The woodyard just runs, and runs without a lot of oversight. The operators know what they are doing, and they produce consistently.”

Ciarletta credits ANDRITZ with helping to train the operators in a very good way. “Our operators were not experienced pulp and paper people,” he says. This is one of the reasons that Georgia Biomass has a service agreement with ANDRITZ for the woodyard. Timo Lintunen, Service Engineer, visits the plant regularly. “Timo has been a big help training and working with our guys in the woodyard,” Ciarletta says. “He checks to make sure that everything is set up correctly, and is a good sounding board for our people.”

“The woodyard just runs – and runs without a lot of oversight. The operators are well-trained and know what they are doing. ANDRITZ played a big part in this.”

Ken Ciarletta,
Commercial & Supply Chain Director,
Georgia Biomass

▲ Ken Ciarletta (left) of Georgia Biomass with Bernard O’Connor, ANDRITZ Wood Processing at the debarking drum in the woodyard.

One-stop-shop for pelleting

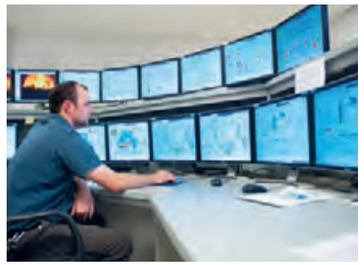
Once the chips are dried to the proper moisture content, they enter a two-stage hammer mill process which grinds them to the optimum size for the pelleting process. Ciarletta is impressed with the rugged design of the mills. “The ANDRITZ hammer mills are very reliable,” he says.

The next step is conditioning: mixing steam with the wood particles to activate the natural binder (lignin) just prior to pelleting. Georgia Biomass operates 22 ANDRITZ pellet mills. “They operate well,” Ciarletta says. “There were some issues at start-up,

◀ Georgia Biomass operates 22 large ANDRITZ pellet mills to produce 750,000 t/a of pellets.

▲ It was only 14 months from the first turn of a shovel to production of the first pellet. This view shows the thermal driers and power boiler in the foreground (right) and the pellet plant in the background.

Georgia Biomass is highly automated for safety, quality, and efficiency (only 16 people per shift). ▼



▲Timo Lintunen, ANDRITZ Service Engineer (left), reviews maintenance procedures for the chipper with Frankie Gamage, Woodyard Operator of Georgia Biomass. ANDRITZ has a maintenance service agreement with the plant for woodyard services and replacement parts.

“We have a maintenance agreement with ANDRITZ. Their specialists work with our guys in the woodyard to keep the equipment availability high.”

Ken Ciarletta,
Commercial & Supply Chain Director,
Georgia Biomass

but when ANDRITZ changed the lubrication systems, it helped tremendously. We also buy all our replacement dies from ANDRITZ.”

Fast track – and moving up

“Commissioning and start-up were on very steep curves here,” Ciarletta says. “It was only 14 months from the first turn of the shovel to production of the first pellet. Five months after that we were running at capacity.”

Ciarletta says that his company benchmarks their pellet quality against other world-class plants. “Moisture, pellet durability, fines content, and temperature are the most important criteria,” he explains. “Pellets are living things, so this must be taken into account. Their internal temperature will increase over a certain period of time. Too hot and it can cause a fire. That is why we cycle our inventory so carefully.”

Georgia Biomass is averaging about 2,200 t/d production. According to Ciarletta, that equals 24-26 railcars a day, one full train every 1.5 days, and one full ship (30,000 metric tonnes) from the harbor every nine to 10 days.

“You can see the numbers and still not grasp the magnitude of what is being produced here,” Ciarletta says. “I’ve been in the business 30 years and when I see the amount of green chips coming off the belt, or the amount of pellets coming out of those 22 pellet mills, it is overwhelming. Considering how lean we are (only 16 people per shift), it is quite an accomplishment.”

Wood pellets offer a standardized means of moving carbon-neutral energy around, at a relatively low cost. RWE had scientists analyze the entire chain from tree to power station. The result shows that RWE is producing 75% less CO_2 in its European power station using wood pellets, compared to those burning coal.

“RWE’s investment in Georgia Biomass was strategically important in securing a renewable and sustainable fuel base,” Ciarletta says. “If a sizeable market for wood biomass emerges in North America, it is likely to be in the form of a market for pellets.”

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Bulk is an essential characteristic for some paper and board products. But one of the challenges of papermaking has been that achieving a smooth surface on paper has meant a considerable reduction in bulk. The latest innovation from ANDRITZ Küsters, the *Prime*Cal Y, overcomes the challenge by enhancing gloss and smoothness without compromising too much of the sheet’s bulk and stiffness. The first unit has been sold and will soon ship.

A well-recognized brand

We are visiting the ANDRITZ Küsters facility in Krefeld, Germany, which has a long tradition of innovation since its beginning in 1953. The founder, Eduard Küsters, was a pioneer in deflection-controlled rolls. Today, ANDRITZ Küsters offers a full range of calendering systems – hard nips, soft nips, multi-nips, and shoe press calenders.

The conversation today is with Gerhard Gabriel, Director of Product Development, and Peter Svenka, Senior Product Development Manager. Gabriel and Svenka have something new to show us.

An innovation from ANDRITZ Küsters, the *Prime*Cal Y calender, uses belt calendering to achieve desired paper or board surface properties while preserving the maximum amount of bulk. “The advantage of belt calendering with moisturizing is that a smooth, glossy finish can be put on the sheet with lower roll temperatures and lower nip pressures,” Gabriel says. “This saves energy and preserves bulk.”

The *Prime*Cal Y belt calender undergoing testing at the ANDRITZ Paper Technology Center in Krefeld, Germany. ▶

The use of computational modeling tools allows Center personnel to duplicate commercial production speeds and scale. ▼

> *The advantages of belt calendering with moisturizing is that a smooth, glossy finish can be put on the sheet with lower roll temperatures and nip pressures. This saves energy and preserves bulk."*
>
> Gerhard Gabriel,
> Director of Product Development,
> ANDRITZ

"We ran a lot of trials on our pilot *Prime*Cal X shoe calender and saw the limitations of its soft belt, and the advantages of its long nip," Svenka says. "Our development of *Prime*Cal Y, which began in 2008, was to take the limits off the shoe calender's limitations and expand upon the strengths."

Limiting the limitations

The objective of calendering is to soften the surface of the paper so that it can be mechanically smoothed in the nip. The main control factors are temperature, nip pressure, and dwell time (the time that the paper sheet is in contact with the calender roll).

A calender roll is heated so that the surface of the paper can reach the glass transition point, the point at which the wood and cellulose fibers change from a solid to a malleable state (typically in the 200-260° C range with low moisture content). "The way to preserve bulk is to heat only a thin layer underneath the paper surface to the transition point, while the inner layer stays below transition and remains unchanged," Svenka explains. "But this is difficult to do when the dwell time of a typical heated calender is only one millisecond. Roll temperatures have to be set extra high, which requires special roll material and the consumption of more energy, which is then lost to the atmosphere. Plus, for a sheet with poor formation, the high roll surface temperatures can result in excessive mottling."

> *PrimeCal Y is designed to remove a shoe calender's limitations and expand upon its strengths."*
>
> Peter Svenka,
> Senior Product Development Manager,
> ANDRITZ

Gradients to the rescue

The development work began in 2008. "We built a prototype in early 2009 and tested it extensively," Svenka explains.

"I believe we have made all the possible mistakes on our pilot machine and have made adjustments to the product so that they will never happen on a paper machine," Svenka smiles. "For example, at first, it was difficult to control the position of the belt. We have very precise sensors measuring the edge position, and the belt width does not have to be absolutely precise. Our control software was too precise, over-reacting to every change. Our programmers tuned the algorithm, then things ran very stably."

The key to the *Prime*Cal Y is the use of temperature and moisture gradient calendering technology. "These concepts have been around for many years but were often considered separately from each other," Svenka says. "Control of the moisture gradient allows us to first moisturize the sheet to lower the glass transition point. An even water layer is misted on the web surface to keep the water in the surface layer of the sheet only."

In the *Prime*Cal Y belt calender, after the surface of the sheet is moisturized, a belt presses the sheet against a heated roll in the pre-heating zone. The contact time between the sheet and the heated roll can be precisely controlled. The angle and degree of wrapping can also be controlled. "With this belt, the dwell time is more than 50 times longer than in a hard-nip calender," Svenka says. "Because of this, the temperature of the heated roll needs to be only 20-30° C above the glass transition point. We can properly soften the paper surface using moisture and temperature, use lower line forces in the roll nip, and achieve the desired calendering effect. Lower compression rate means that bulk is preserved.

"Since the belt guide rolls do not touch the heated roll, there is no danger of belt marking or delamination during a web break or threading, which is a huge improvement over traditional shoe or belt calenders," Svenka adds.

Adjustability with energy-saving benefits, too

Belt calendering technology can be applied to all paper grades and basis weights. Unlike a shoe calender, where the nip presses through the belt, the *Prime*Cal Y's nip is behind the belt, and completely independent from it. "You can use any kind of nip roll," Gabriel says. "For example, our *Prime*Roll MHV to ensure exact CD caliper control."

*Prime*Cal Y offers another welcome benefit: cost savings. Because the calender's heated roll temperature is significantly reduced – only 20-30° C above the glass transition point – there is considerably less energy loss when compared to a traditional calender with a high roll surface temperature.

"This is actually a very flexible machine because it gives papermakers control of the glass transition point and the gradient degrees," Svenka says. "You have precise control of the temperature, wrapping length and angle (dwell time), pressure, and moisture."

For example, when producing a higher basis weight where bulk is important, the papermaker can pre-moisturize the sheet, adjust the roll heating to a defined depth under the surface, and lower the nip pressure. When producing a lower basis weight where high-gloss and densification are desired , the papermaker can amplify the calendering effect by heating the entire sheet and increasing the nip pressure. "Or anywhere in between," Gabriel and Svenka are quick to point out.

ANDRITZ Küsters is planning a first commercial installation in 2013. It will be interesting to learn more about the first mill experience. "This kind of research – in direct response to customer requirements – is the kind of work ANDRITZ is well-known for," says Gabriel.

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Working on **customized solutions**

Customers from around the world can be seen doing product research and pilot trials at the ANDRITZ Paper Technology Center in Krefeld, Germany, which is replete with a paper lab and pilot machines. "We enjoy a close relationship with our customers and encourage them to use our facilities," Gabriel says.

On-site pilot machinery available for customer trials includes: *Prime*Cal (soft, hard, X, and Y) and *Prime*Cal ProSoft (multi-nip). There is also a *Prime*Feeder Tail threading and web guidance system.

With the use of computational modeling tools, production speeds and scale can be duplicated. The Center also has a fully instrumented paper lab to test paper characteristics.

De-bottled water

A project to remove the bottleneck caused by an old evaporation plant at Figueira da Foz presented an interesting challenge. Starting up the new evaporation line without shutting down the old made it even more interesting.

With production of about 800,000 t/a of uncoated woodfree paper, Portucel Soporcel's Figueira da Foz mill is one of the largest in Europe. Operations are vertically integrated from the forest to final paper products, including 560,000 t/a of bleached eucalyptus kraft pulp and generation of green energy from biomass.

The mill has a unique history: its production systems were designed and built in the mid-1970's to be installed in the former colony of Angola. After the revolution in Portugal and the independence of the colonies, the equipment was mothballed for several years until a location in Portugal was decided upon. Construction at Figueira da Foz started in 1981.

From 880 to 1,600

João Prina, a chemical engineer by training, came to Figueira da Foz at the age of 24 during the mill start-up in 1983. The three other shift engineers hired with Prina at the time are also still working at the mill.

Prina is now Pulp & Energy Production Director. He recalls the initial design capacity of the digester – 880 adt/d. "Much of the main equipment, including the digester, is still in place 30 years later," Prina says. "Today we produce 1,600 adt/d with only minor modifications to the digester. Although to be fair, we have had many projects to debottleneck over the years."

One of the big bottlenecks had been the 30 year-old evaporators. "We were sending only 67% dry solids liquor to the boiler," Prina explains, "but after the installation of the ANDRITZ recovery boiler in 2005 and a new turbine for high-pressure steam in 2010, it was a natural step to increase the energy efficiency of the evaporation plant."

In addition to higher dry solids, the mill wanted to improve the quality of the condensates to get better washing in the fiberline. "And, as you can imagine," Prina says, "the old evaporators required cleaning every three to four months, so we wanted to improve availability."

Fast-track upgrade

The fact that Figueira da Foz's operators were familiar with the lamella evaporator technology did not mean that it was ensured that ANDRITZ would get the order for the upgrade to the evaporation plant, according to Prina. "It would be comfortable for us to keep a technology we knew, but our minds were open to evaluating competitive technologies."

◀ Prina (left) with José Henriques of Exporatlas, ANDRITZ's representative in Portugal.

> *"It was a natural step to increase the energy efficiency of the evaporation plant."*
>
> João Prina, Pulp & Energy Production Director, Portucel Soporcel

Knowing this, Sanna Semi, Sales Manager, led the sales effort for ANDRITZ. "We knew we would have to think out-of-the-box with a more cost-effective approach in order to win the business," she says. "Our proposal was to retrofit part of the existing plant and deliver a smaller four-effect line that would work parallel. We also planned for the future with our design that allows for the addition of two more evaporator effects. In addition, we proposed an integrated foul condensate treatment system and a common concentrator for both lines. We planned to do this over a very short shutdown period – know-

ing that our approach would be a less risky and more cost-effective way for the mill to get the capacity it required at 75% dry solids content."

No shut start-up

Working with José Henriques of Exporatlas, ANDRITZ's representative in Portugal, Semi and her team were able to win the order in July 2011. Start-up occurred on schedule in September 2012.

Tapio Lintunen was the Project Manager for ANDRITZ. "This was a very interesting project for me," Lintunen says. "In my 33 years of project work, this is the first time we did not need to stop the existing line to start up the new one. Normally, we have a shutdown to perform the tie-ins, but we designed the project so that a stop was not needed."

This was accomplished by doing pre-work on the existing line during the mill's normal January 2012 shutdown. "We installed surface condensers in the old line and put in valves instead of blind flanges. This way, the new line and shared equipment could come on-stream without shutting down the old plant again," Lintunen says.

▲ Lab technician performing tests on black liquor (dry solids and composition).

◀ ANDRITZ engineers Otto Greis (left) and Juha Latva-Koivisto in the new evaporation plant.

"We knew we would need a very cost-effective approach to win the business."

Sanna Semi,
Sales Manager, ANDRITZ

◀ (Left to right): João Ferreira, Process Engineer in the recovery area; Sanna Semi of ANDRITZ, and João Prina.

The work was challenging, according to both Lintunen and Prina, mainly due to the tight quarters and the tight schedule. "We have basically embedded the new equipment into the existing plant and did all the work in 14 months," Lintunen says.

Satisfying results

"We are satisfied with the performance of the plant since its start-up," Prina says. "The project went very well. Safe, on time without delays, on budget, and good results so far. Throughput, dry solids, stripper efficiency, and energy consumption are all as promised.

"I can say that we get very good support from ANDRITZ. When a problem appears, we work together to solve it. Being a process guy, I appreciate very much that we have easy communications whenever we have a process or operational question."

Today, Figueira da Foz is burning 74-75% dry solids and has reached the design capacity of 120 t/h evaporation. "The condensate quality is very high," Prina says. "I have to admit we oversized the stripper a bit because of problems in the past. So there is no problem stripping 100% of the condensates."

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▲ Duct stripping technology (patented technology from ANDRITZ) which removes methanol and residual sulphur components from condensate flows. The benefits are significantly reduced COD to the effluent treatment plant, less energy usage when heating secondary condensate, and lower water consumption by using clean odorless condensate instead of fresh water.

▲ New four-effect evaporation plant shown in foreground. ANDRITZ recovery boiler (installed in 2005) in background.

From old to new **in nine days**

◀ Two of the newly reconditioned headboxes on Gernsbach's KM2 machine.

Even though headboxes are designed to work in demanding environments, their performance will degrade over the years as heat, chemicals, moisture, and vibration take their toll. A total reconditioning of a pair of headboxes on a board machine in only nine days – from de-install to re-install – sounds like a mill manager's daydream. But it was a reality at Mayr-Melnhof's Gernsbach mill in Germany.

The Mayr-Melnhof Group is regarded as a world leader in the production of coated cartonboard made from recycled fiber. It also has a growing position in virgin fiber-based board and is the leading manufacturer of folded boxboard in Europe.

The Gernsbach mill in Baden-Württemberg has been involved in the production of cartonboard since 1951. The grades produced at Gernsbach are characterized by consistently high quality and are in demand for food and non-food packaging.

Gernsbach's KM2 machine produces white-lined chipboard in the 240–260 gsm range from 100% recycled fiber. The fiber source is mostly from Germany. KM2, which has four fourdrinier formers, has a width of 3.3 m.

Headboxes exhausted

According to Carmine Nagel, Gernsbach's Technical Manager, in 2010 it was deemed that the four headboxes on KM2 were "worn out" and reaching the end of their productive lives. "Everything has to be precise in a headbox," Nagel says. "The most obvious points of wear that we could see were the headbox tables and the bottom layer base frames, which were corroded. This wear in the headbox tables can lead to formation problems, sheet breaks, and other quality problems. The corrosion in the base frames presented a potential safety problem or an unplanned full stop of the machine."

◀ Carmine Nagel (left), Gernsbach's Technical Manager, with Johannes Kraxner, ANDRITZ Product Manager for Paper Machine Services.

◀ Nagel and Kraxner with one of the four reconditioned headboxes. In addition to safe and stable production for future years, the headbox reconditioning improved the quality of the sheet by enabling better CD moisture profile control.

Chemicals play a role

The headboxes were from the early 1990's. According to Johannes Kraxner, ANDRITZ's Product Manager for Paper Machine Services, the standards and materials used in headboxes in 1990 were quite different than for today. "Some of the chemicals used today have a negative effect on a headbox built 23 years ago," Kraxner explains. "The protective coating on the metal gets dissolved or abraded, which fuels corrosion."

"We know that these components have a certain lifespan," Nagel says. "New standard headboxes are larger than ours, so replacement was not really an option for us. It would have involved re-designing or ordering custom-sized headboxes, which would have been very costly. ANDRITZ proposed a plan to recondition our existing headboxes in two phases, which was a perfect and smart solution."

Reputation and relationships matter

"Our decision to go with ANDRITZ was based on reputation, experience, and their detailed plan on how they would approach the project," Nagel says. "This gave us confidence that they knew exactly what they were doing."

Nagel adds that he had never worked with ANDRITZ before in his over 30 years in the industry, and this was an important project for him. "The headbox is, of course, a critical part of our machine. Of course I knew ANDRITZ's reputation, but I had never worked with them. But my first impression of the ANDRITZ people was very positive, which is important also when building relationships."

Detailed planning, speedy execution

It was decided to perform the reconditioning in two phases: two headboxes in December 2010 and two headboxes in December 2011. The agreed upon downtime for each service was nine days. It sounds like a short time – but is it?

"It most certainly is," says Kraxner of ANDRITZ. "This could only be accomplished with detailed planning followed by precise execution. There was no margin for error."

ANDRITZ's work began with supervising the removal of the headboxes from the machine and transporting them some 600 km to the workshop in Graz, Austria in the winter time. "This sounds very normal, but we knew it would be a challenge," Kraxner explains. "Our schedule was based on removing the bottom layer headbox without having to dismantle the complete wire section for the filler layer. There was such a narrow space to work that we had to design a special lifting tool.

"When you recondition any equipment, you never know what conditions you will find when dismantling and disassembling the equipment," Kraxner says. "We sent two specialists from ANDRITZ to supervise the Gernsbach team who did the actual dismantling."

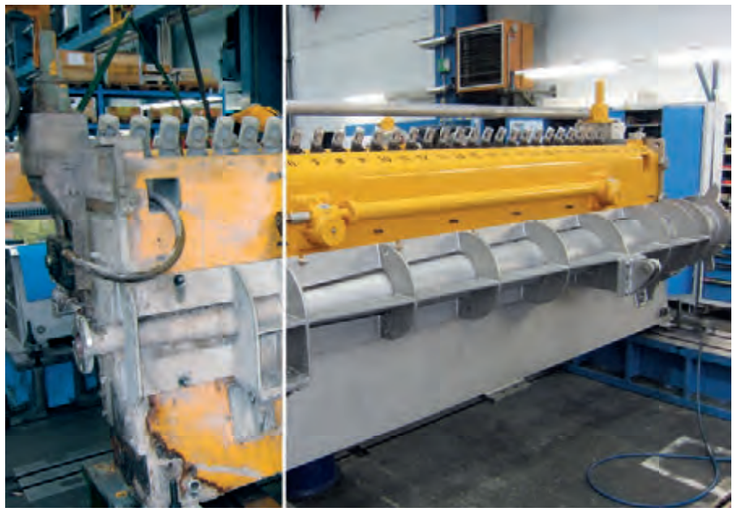
Technicians and machinists were ready for the arrival of the headboxes in Graz. They moved quickly into action to completely disassemble the headboxes, sandblast and paint all the steel parts, clean the stainless steel and bronze parts with a ceramic blast, plane and grind the bottom and top slice lips, and exchange all the gearboxes used for adjusting the profile.

The machinists also manufactured new headbox tables and produced new base frames for the bottom layer headboxes to replace the corroded ones. After assembling and adjusting all components, the "new" headboxes trucked back to Germany and installed back into KM2.

Nagel sent a recent retiree and one of his best people to Graz to inspect the work by ANDRITZ. "He was there when the headboxes arrived and gave me daily updates," Nagel says. "He was very impressed with how ANDRITZ operated its workshop and how people worked night and day on the reconditioning."

▼ Headbox (before reconditioning).

▼ Headbox (after reconditioning).



Amazing start-up

"We stopped our machine for nine days and we were producing saleable product right after day nine," Nagel says. "This was the challenge we presented to ANDRITZ, and what they agreed to contractually. But there is a difference between seeing a commitment on paper and actually watching it happen.

"Thanks to the reconditioning, safe and stable production is ensured for many years. And, with the rebuilt headboxes, we have been able to improve quality by increasing our cross direction moisture profile control."

"All is good!"

"During the second reconditioning in 2011 we were conducting a very large rebuild of our coating section," Nagel says. "Based on our good experience with the first phase of the project, I knew I did not have to worry about phase two. I heard only positive feedback from my colleagues about the ANDRITZ headbox service, so I focused on the coating rebuild. I was confident that my partners at ANDRITZ would deliver on time.

"This project with ANDRITZ was truly a success story," Nagel summarizes. "We planned a small celebration dinner once the reconditioned headboxes were started up. The table was reserved. The headboxes were up and running so perfectly, producing good product within 15 minutes that we all went to the restaurant early. We enjoyed the meal, returned to check on the headboxes, and they have been running flawlessly ever since. All is good!"

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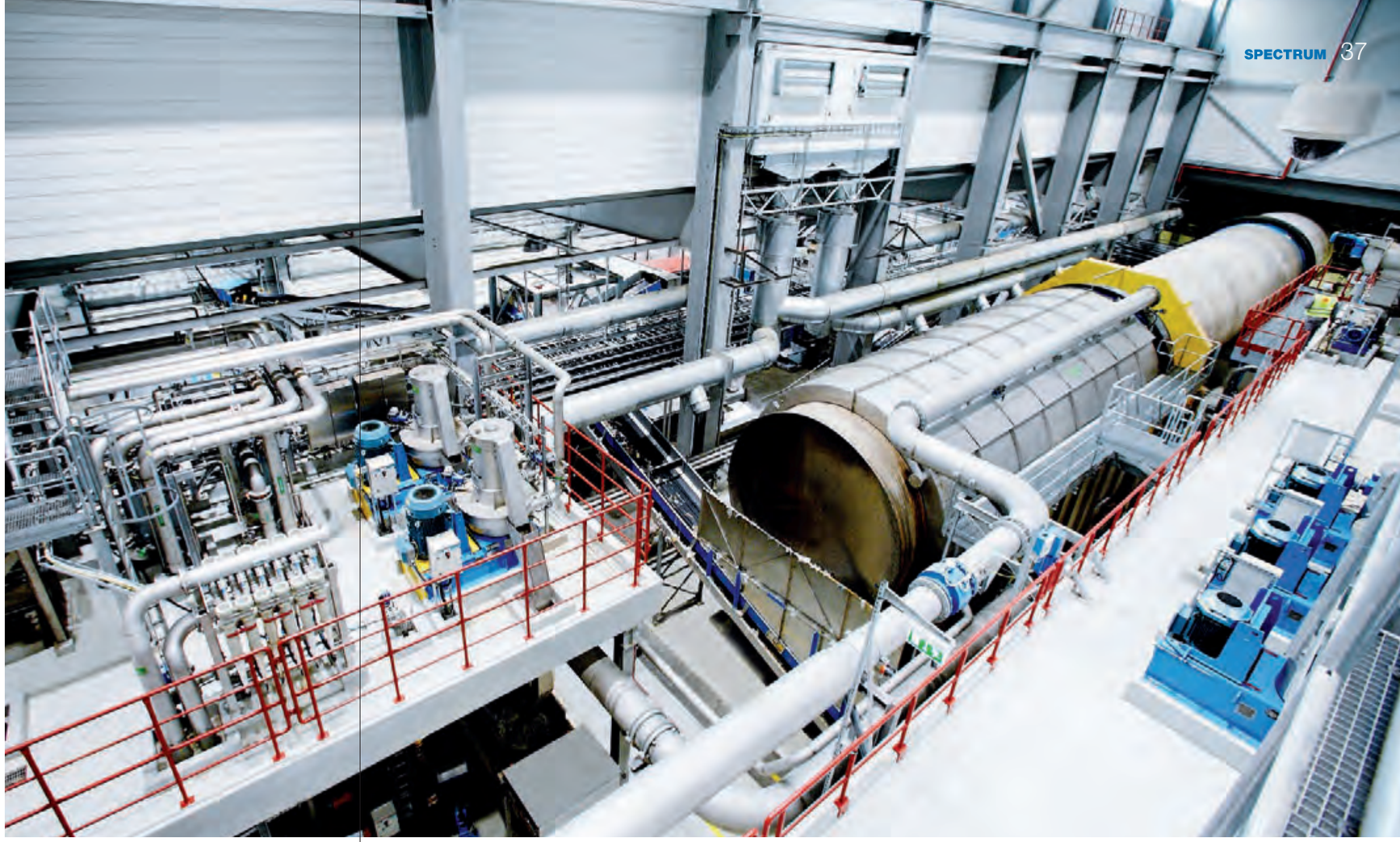
"We stopped our machine for nine days and we were producing saleable product right after day nine."

Carmine Nagel,
Technical Manager,
Mayr-Melnhof Gernsbach

Recykling gets big boost in the heart of Europe

The word “recykling” is relatively new in the Polish language and culture. Only 39% of paper and board is recycled in Poland (the lowest in the EU), but this is quickly changing. With new collection and sorting infrastructure coming into place, Stora Enso’s investment at its Ostrołęka mill is timed perfectly. ANDRITZ delivered the complete recycled fiber processing line – and a unique reject treatment system.



Nearly two million tonnes of valuable recyclable raw material goes to landfill or waste every year in Poland, mainly due to the lack of an effective waste management infrastructure. This is all changing in 2013 as Poland is establishing a common waste tax to fund the infrastructure development in order to meet European standards. The EU has directed that by 2020 at least 50% of the paper, plastic, glass, and metals in Poland’s municipal waste must be sorted out and reused.

Even with the lack of a public system, companies like Stora Enso “did not just stand by and watch as valuable materials were dumped into landfills,” says Michal Gawrych, Sales and Logistics Director at Stora Enso’s Ostrołęka mill. “We created our own national network of 20 collection and sorting stations. Our system is one-of-a-kind in Poland.”

The baled OCC and mixed waste is transported to Stora Enso’s Ostrołęka mill and recycled into packaging paper and finished boxes. As of January 2013, the mill has an additional “hungry mouth” to feed – the new PM5. PM5, with a capacity of 455,000 t/a of 65-140 gsm testliner and fluting, produces more than five times the capacity of the machine it replaced.

A new 1,665 t/d recycled fiber (RCF) line from ANDRITZ – the most modern OCC line in Europe – feeds the hungry machine. The rejects from the RCF plant are processed in a unique system, also from ANDRITZ, that helps fuel the mill’s new power boiler.

Ostrołęka mill

The Ostrołęka mill, located about 120 km from Warsaw, was built in 1959. It is the largest mill in Stora Enso Poland: comprising a pulp mill, paper mill, power block, corrugated board and box plant, and a sack plant.

“Demand for lightweight corrugated packaging is growing,” explains Harri Taipale, Stora Enso’s Project Area Manager for the RCF and effluent treatment portions of the investment. “This expansion project enables us to raise our containerboard self-sufficiency.”

Valuable energy from “waste”

Taipale came to Poland in 2008 to work on the project to build a new power plant and a new demineralized water treatment plant at the mill. “We have the ability to mix fuels in the power boiler,” Taipale says.

The 120 t/d reject treatment system from ANDRITZ contributes significantly to the fuel mix in the power boiler. Michael Waupotitsch, ANDRITZ’s Vice President for sludge and reject treatment, applauds Stora Enso’s focus on mining the valuable elements out of its waste streams. “The metals and plastics in rejects used to be discarded by mills,” Waupotitsch says. “Now they are a stream of additional revenue and a valuable energy source.”

▲ As Poland expands its recycling infrastructure to meet EU standards, Stora Enso has been actively involved. The 1,665 t/d recycled fiber line and advanced reject processing system from ANDRITZ is one of the EU’s largest, and certainly the most modern.

◀ (Left to right) Gerhard Knes, ANDRITZ Senior Project Manager; Harri Taipale, Stora Enso’s Project Area Manager; and Karol Janczewski, Stora Enso’s RCF and ETP Process Engineer.

The FibreFlow Drum pulper and the coarse screens in the RCF plant remove the large contaminants very early in the pulping process. ANDRITZ designed the reject treatment system and integrated the metals separators, compactors, shredders, and the conveying systems. According to Waupotitsch, “Rejects are run through a series of steps to recover the fiber, separate the metals (both ferrous and no-ferrous metals are recycled), and separate the plastics which are burned in the boiler.”

The plastics portion of the line employs a unique device using Near Infrared Spectroscopy to separate “good” plastics from PVC. As Waupotitsch explains, “PVCs are landfilled due to their high chlorine content which could have a negative impact on the boiler internals. All other plastics are burned in the boiler.”

A good foundation for progress

Stora Enso signed the contract with ANDRITZ in June 2011. “We knew right away that completing the civil works before winter was going to be a really big push for us,” Taipale says. “ANDRITZ managed to quickly get us the engineering drawings we needed. This set a good foundation for keeping to a very challenging time schedule throughout the project.”

“I like project work. There is no routine – no two days are the same. And of course there are always challenges, but with good partners we always find a solution.”

Harri Taipale,
Project Area Manager,
Stora Enso

“We had a good professional and personal relationship with the Stora Enso team from the very beginning,” says ANDRITZ Senior Project Manager, Gerhard Knes. “Communications and cooperation were excellent.”

The ANDRITZ team worked to fine-tune the RCF system to focus on Stora Enso’s goals of reducing energy consumption and reducing waste to landfill. Alexander Singer, Vice President of Recycled Fiber/OCC for ANDRITZ, says, “By making modifications to the layout and interfaces, we were able to improve the overall design. For example, we used frequency converters to save energy, and added bypass capabilities in the piping.”

Happy with the technical solutions

As you walk through the RCF plant, the first impression is that the main components are very large. Second impression is that it is a very compact and well-thought-out layout. “Some of our suggestions even helped reduce the footprint of the installed equipment and therefore the size of the building,” Singer says. “Not only does this increase

◀ Baled OCC and mixed waste is transported to Stora Enso’s Ostrołęka mill and recycled into packaging paper and finished boxes. With a capacity of 455,000 t/a of testliner and fluting, Ostrołęka’s new PM5 produces more than five times the capacity of the machine it replaced.

▲ The advanced 120 t/d reject treatment system from ANDRITZ separates metals, plastics, PVC, and coarse material such as sand (above). Plastics become fuel for the mill’s power boiler. Metals are recycled. Sand and PVC materials are sent to landfill.

▲ After the FibreFlow drum slushes and de-trashes the fibers, the downstream processes of screening, cleaning, fractionating, and thickening occur. Long and short fibers are fractionated in the RCF plant to supply the two-layer headbox on PM5.

efficiency, it also saves energy as there are shorter pipe runs, smaller pumps, etc.”

“I am really happy with the technology solution that we came up with,” Taipale says. “For example, there is a tight limitation on the daily effluent that we can release to the river. We worked with ANDRITZ to separate the different water loops to reuse as much water as possible and have tight control over COD and BOD levels. That is why we selected, for example, the ANDRITZ screw presses. Fresh water consumption here is a quite low.”

Asked what was a major learning for him working on an RCF project for the first time, Taipale says, “It seems that what you put in – you get out. The equipment can tolerate variations, as raw materials can change within a short time. We focus a lot of our efforts on controlling the raw material mix and getting the trash out early.”

After the drum slushes and de-trashes the fibers, the downstream processes of screening, cleaning, fractionating, and thickening occur. Long and short fibers are fractionated in the RCF plant to supply the two-layer headbox on PM5.

Pipeline to old machine

Knes explains that they put a pipeline from the RCF to feed the old PM4 machine (located in another building) in order to start-up and optimize the plant prior to the start-up of the new PM5. “I thought the pipeline would be removed after start-up, however we are still feeding both machines,” he says. Taipale explains that by running lower grammages of testliner and fluting, “We can use the full capacity of the ANDRITZ RCF plant. The PM4 operators also like the new pulp from the RCF plant. The cleanliness and quality of the pulp from the new line is that much better.”

“No two days are the same”

“I like project work,” Taipale says. “There is no routine – no two days are the same. And of course there are always challenges, but with good partners we always find a solution.”

The team at Stora Enso considers ANDRITZ a good partner. “We had an excellent level of performance and cooperation from the very beginning,” Taipale says, “from layout to engineering, to erection, to start-up. And we managed to keep all the time schedules.”

The ANDRITZ RCF plant started up in December 2012 and the new PM5 started up in January 2013. “Our ramp-up was according to plan,” Taipale says. “Start-up of the machine was about one month earlier than originally planned.”

With PM5 online, Stora Enso now has a very integrated approach in Poland. It owns the raw material collection network, owns the new plant for producing the paper, and owns the converting plant for making the paper into boxes.

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◀ Egon Rettenbacher, ANDRITZ Site Manager (left) and Heinz Kleinbichler, ANDRITZ Start-Up Supervisor

Light roast or dark roast? **One pellet or two?**

Torrefaction of biomass (“roasting” in an oxygen-free environment) is a proven concept – but not at the large scale required to co-fire Europe’s coal burning boilers. ANDRITZ has started up two unique pilot plants in Europe that could be game-changers for solid biofuels development.

When you drive moisture and hemicellulose out of wood biomass without burning it, you create a fuel that is approaching the characteristics of coal,” explains Brian Greenwood, Technical Director for Biorefining at ANDRITZ. “Power producers love it because they avoid making costly modifications to their boilers and feed systems, and they can co-fire with higher proportions of biomass.”

The torrefied biomass is very dry, organic rich, and easily turns into powder. “The ability to both torrefy and pelletize biomass at commercial scale without expensive binders is challenging,” Greenwood continues. “The labs can produce kilos of pellets – not the tonnes needed for industrial use.”

This explains why ANDRITZ’s new Biomass Torrefaction Pilot Plant near Sdr. Stenderup, Denmark is gaining so much attention. It is designed to not only prove the technology concept for large-scale production (think 700,000 t/a within a few years), but also to pelletize the torrefied fuel.

Realizing that not everyone might want a large centralized production plant, ANDRITZ is also demonstrating a complementary technology for smaller decentralized plants at another pilot plant in Frohnleiten, Austria.

Converting mass to gas

The Sdr. Stenderup pilot plant combines the technologies of three ANDRITZ business areas – rotary dryer from one, torrefaction process from another, and pelletizing machinery from a third. “If our concepts and technologies can be proven at this scale, it will open the door for ‘black’ pellets (dark-roasted torrefied wood) to replace the conventional ‘white’ pellets (standard wood pellets) of today,” Greenwood says.

Torrefaction is conducted at relatively low temperatures (250 – 300° C) in an inert atmosphere (free of oxygen). During the process, the hemicellulose in the biomass is decomposed, creating by-products such as water, carbon dioxide, carbon monoxide, and various organic acids. Depending on the process, up to 30% of the mass is converted, but little energy is lost, which causes the overall energy density to rise.

The increase in calorific value of the biomass can be more than 20% on an energy/mass basis. The gas released is burned to generate the heat needed to operate the torrefaction process.

EU driving the development

The coal-like properties of torrefied biomass are important, according to Jaap Kiel, Biomass Program Development Manager at the research institute ECN in the Netherlands. “EU directives are pushing for reducing carbon emissions and increasing renewable energy shares up to 20%,” he says. “Co-firing biomass with coal in power stations is an attractive short-term option.”

Co-firing of traditional wood pellets has been demonstrated at several locations and the boiler efficiencies have not suffered considerably. However, without major modifications the maximum share of wood in the fuel blend can only be about 5 – 15%. The chemical and physical properties of the wood pellets differ too much from coal.

Kiel explains that the differences between “white” wood pellets and coal set demanding requirements for power plants. “For conventional wood pellets, outside storage is not practical,” he says. “Separate, dedicated storage and milling facilities are required and a high percentage of co-firing will lead to a substantial derating of the power plant.”

“From a technology development point of view, there are two ways to approach it,” Greenwood says. “You can either adapt the power production technology to fit the biomass – or you can adapt the biomass to fit the power production technology.” Which is why the power industry is looking so closely at torrefaction. The calorific value (energy per unit of weight) is higher. It is denser (energy per unit of volume). The absorption of water is significantly lowered and the microbial degradation is slowed (making it possible to store outside). Plus, little or no modification to existing boilers is required.

Kiel sees a huge potential. “With white pellets, co-firing requires substantial investments and leads to lower plant capacity,” he says. “With black pellets, 50 – 100% co-firing levels can be reached without major investments, while largely maintaining plant capacity.”

> *“Power producers love torrefied material because they can avoid making costly modifications to their boilers.”*
>
> Brian Greenwood,
> Technical Director for Biorefining,
> ANDRITZ

(Left to right): Kiel of ECN, Greenwood of ANDRITZ, and Melson of ANDRITZ in front of the vertical torrefaction reactor. ▶

Two approaches

In addition to plant size, according to Doris Thamer, ANDRITZ Senior Sales Manager for Thermal Systems, the primary difference between the Sdr. Stenderup and Frohnleiten pilot plants is the technology approach.

"Our Frohnleiten plant uses an indirectly heated drum reactor that we developed," Thamer says. "Sdr. Stenderup uses moving bed technology, which we developed and use in the Pulp & Paper industry. It is best for extremely large plants. The drum reactor is designed for 50,000 t/a, a size that can be transported by truck to a decentralized site, for example near a sawmill or chipping plant."

The Frohnleiten plant is based on ANDRITZ's ACB (Accelerated Carbonized Biomass) process: drying, torrefaction, combustion of lean gas (energy supply), conditioning, and briquetting. The special design of the drum reactor seals out oxygen and makes it possible to control the retention time and temperature quite effectively. "The mechanical design of this drum is well-proven in sludge drying applications," Thamer says. "We have more than 110 of these units installed."

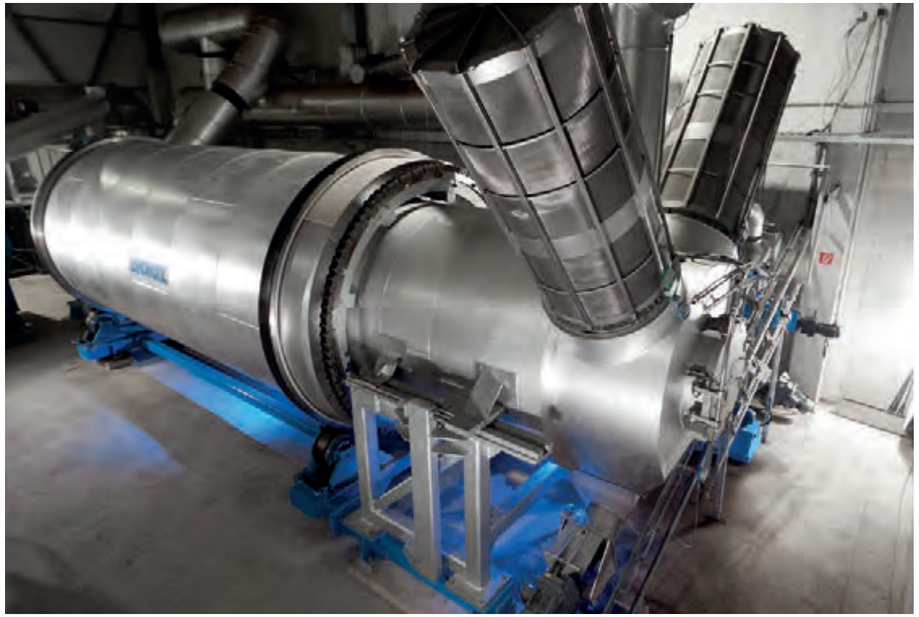
Inside the Sdr. Stenderup facility

The pilot plant incorporates biomass receiving, drying, torrefaction, and pelletizing in an integrated system. The torrefaction process blends ECN and ANDRITZ technologies and has been patented. Fresh wood chips are first dried in an ANDRITZ rotary drum drying unit to reach the desired moisture content for the reactor.

The heart of the process is a vertical pressurized reactor. Inside the reactor are trays (beds) stacked vertically. Dried wood chips enter the reactor at the top, "roast" in the hot gases passing through the biomass and perforated trays which rotate to ensure even distribution, then drop to the tray below for another stage of torrefaction. The torrefied material is discharged at the bottom of the reactor vessel.

From the reactor, the torrefied material passes through a cooling screw to a storage silo. For the densification process, the material passes through an ANDRITZ Hammer Mill for crushing to uniform size before entering the ANDRITZ pellet press, resulting in an energy-dense torrefied pellet that can be stored and shipped to customers.

▲ Aiming to prove the technology for pelleting torrefied biomass at industrial scale are Orla Fielsø (left) and Henning Juhl Møller from ANDRITZ Feed & Biofuel in Denmark.



Torrefaction reactor at the ACB pilot plant in Frohnleiten, Austria. ▶

▲ The ANDRITZ rotary dryer at the Sdr. Stenderup plant dries biomass prior to entry into the torrefaction reactor.

▲ Overview of the Sdr. Stenderup plant showing the ANDRITZ vertical pressurized torrefaction reactor.

According to Allan Melsen, ANDRITZ Plant Manager, the process design was analyzed according to ATEX procedures dealing with potentially explosive atmospheres. "Torrefied dust is potentially explosive when mixed with air," he says. "We spent considerable engineering effort and investment to reduce the risk. This included extensive testing of eucalyptus and pine dust. We have put in place safety systems to mitigate the risk of fire and explosions."

Partners in development

The demonstration plant is partially funded by the Danish EUDP (Energy Technology Development and Demonstration Program), but the majority of capital funding comes from ANDRITZ. The Danish Technology Institute (DTI), Danish energy company Dong, and British energy company Drax are also part of the EUDP team. ANDRITZ and DTI have a long history of cooperation in the area of wood pelleting. DTI has been researching the use of biomass for large-scale energy production.

"It is exciting to be involved in a project that has such potential to reduce greenhouse gases with renewable fuels."

Robbie Diaz,
Project Manager,
ANDRITZ

ECN is acting as a consultant to ANDRITZ on the design of the torrefaction technology and is assisting in optimizing the pilot plant. ANDRITZ signed a cooperation agreement with ECN in 2011 to license some of its technology for co-current drying and countercurrent torrefaction of biomass.

Not just black and white

According to Greenwood, torrefaction is not just a matter of black pellets vs. white pellets. His team aims to experiment with degrees of torrefaction in between so that an energy producer can choose the right product for his particular boiler. "It is kind of like going into a coffee house and specifying light, medium, or dark roast," he says. "But we have to walk before we can run, so now our attention is on the first stages of torrefying and densifying."

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