



SPECTRUM

SPEED OF SUNLIGHT

Shandong Sun Paper // 14

NEXT-GENERATION PULPING?

Timo Merikallio Interview // 39

POWERFUL RECOVERY

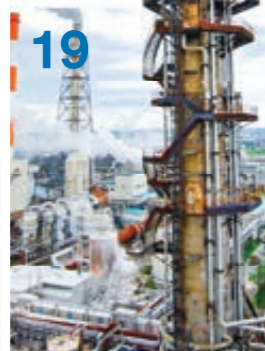
Electricity Authority of Cyprus // 48



A BIG CAT IS RISING

The Greenfield "Puma Project"
in Brazil is garnishing respect
all around the globe // 30

ANDRITZ
Pulp & Paper



Switch on **GREEN POWER** solutions from **ANDRITZ**

More and more companies are switching on their **GREEN POWER** options. **ANDRITZ** offers a range of technologies for producing solid biofuels, liquid biofuels, and even energy from waste by-products.

We have included several stories in this issue of **SPECTRUM**, highlighted with the **GREEN POWER** symbol, which showcase our customers' successes with renewable energy technologies.

New dots on the map bring new capabilities.

Finland, Sweden, Brazil, China, Indonesia, Mozambique, Belarus, Siberia ...



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



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

CONTENTS

- 03 Management Message
- 04 Orders & Start-ups
- 05 News
- 06 Ethanol from cellulose
ZeaChem Inc.
- 10 Process OPE
Arauco Celulosa
- 14 Speed of sunlight
Shandong Sun Paper
- 19 Diversifying with rayon pulp
Nippon Paper Group
- 22 A Russian game-changer
Naberezhnye Chelny Board & Paper Mill
- 26 New whiter product, higher performance
Fujian Liansheng Paper Co.
- 30 A big cat is rising
Klabir S.A.
- 36 "They made things right"
Eldorado Celulose S.A.
- 39 Next-generation pulping?
Timo Merikallio Interview
- 42 Market-oriented DIP
ANDRITZ deinking systems
- 44 Fast and green
Mondi SCP
- 48 Powerful recovery
Electricity Authority of Cyprus
- 53 Blackburn Meadows revived
E.ON
- 56 Unlike any other
EPD Hong Kong
- 60 Did you know that?

Mozambique, Belarus, Siberia?

For a variety of reasons – be it tapping new fiber sources, meeting the global demand for long fiber pulp, or moving closer to customers – we now see mills being planned and built in “new” geographies. “New” in that the locations do not have a long tradition of pulp and papermaking.


These “new dots” expand the global map of the Pulp & Paper industry. They also inspire us to enhance our capabilities in order to reduce technical complexity, minimize risks, and provide new service options for mills in non-traditional locations. These enhancements will also be of value to you in your next project.

New or remote locations require a careful evaluation in order for us to select the best approach for project management. After all, successful installations not only require the best technologies, they also require the best organization to handle complex challenges such as logistics, climate, working conditions, cultures, local regulations, etc. Even in projects where the scope is well defined, such as turnkey deliveries, we must be flexible to arrange, and sometimes re-arrange, our packages to meet customer- or site-specific requirements. It does not end there. In many cases, long-term maintenance and service programs are essential to support our customers and keep the mills producing at a steady and high level.

The capabilities we develop for even the most remote projects add to our overall set of tools that we bring to every project. This means that the skills and experience we assemble for the “new dots” on the map are of value to the “established dots” as well. No matter where the project is located – faster execution, faster start-up, higher performance, and a quicker return on investment are the targets.

We hope you enjoy reading this issue of SPECTRUM, which takes you around the world of Pulp, Paper, Power, and Service. Hopefully, we will include stories about the “new dots” in future issues.

Sincerely,


Joachim Schönbeck
Member of the Executive Board
Capital Systems


Humbert Köfler
Member of the Executive Board
Service & Units

SPECTRUM is published by:
ANDRITZ AG
Stattegger Strasse 18
8045 Graz, Austria
Phone: +43 (316) 6902 0
spectrum@andritz.com
Editor-in-Chief:
Björn Hansen
bjorn.hansen@andritz.com
Project Director:
Manuela Wagner
manuela.wagner@andritz.com

Editorial Director:
Robert Puhr
robert.puhr@andritz.com
Editorial Board:
Björn Hansen, Minna Heinonen, Robert Puhr, Regina Puschnig, Dietmar Scherer, Andrea Schlagbauer, Ursula Suppanen, Manuela Wagner, Carina Weissensteiner
Contributing Writers:
Thomas Barbieri, Martin Koepnick, Robert Puhr, Michael Roßker, Gary Thomson
Contributing Photographers:
Martin Koepnick, Riku Isohella, Robert Puhr, Christopher Rausch, Ricardo Sampaio
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On the cover: A big cat is rising (page 30), Cover/page 30: Jamie Gundry – Shutterstock.com;

Highlights

RECENT ORDERS



▲ Metsä Fibre, Äänekoski Finland order includes the largest horizontally fed HHQ-Chippers.

COMPLETE LINES AND SYSTEMS

Metsä Fibre, Äänekoski, Finland
Complete wood processing plant, fiberline, evaporation plant, and recausticizing plant for new-generation bio-product mill

Enviva, North Carolina, USA
HHQ-Chipper, engineering, and field services for biomass pellet plant

Nepa Limited, Madhya Pradesh, India
Complete deinked pulp line

ITC Paperboards & Specialty Paper Bhadrachalam, India
300 admt/d BCTMP line

Cheng Loong Company, Houli City, Taiwan, China
Complete OCC line

Klabin, Ortigueiras, PR, Brazil
Pre-engineering and maintenance contract for Klabin's Puma project (fiberline)

KEY EQUIPMENT, UPGRADES, AND MODERNIZATIONS

Shandong Huatai Paper, Dongying City, Shandong, China
FibreFlow drum pulper, virgin pulp line, and broke system

Phuong Dong Paper, Tien Du Town, Bac Ninh, Vietnam
HD cleaner, screen cylinders, LC cleaner, and screen plates

Georgia-Pacific, Monticello, MS, USA
Hot stock refining and screening

Smurfit Kappa Kraftliner, Piteå, Sweden
Evaporation plant upgrade

PGNiG Termika SA, Siekierki, Poland
Modernization of flue gas cleaning unit

Shandong Sun Honghe Paper, China
Core components for two SCR reactors

Iggesund Paperboard, Workington, England
Rebuild of press section (board machine)
Turnkey delivery of press section (PrimePress X shoe press)

Iggesund Paperboard AB, Iggesund, Sweden
Wet section upgrade including new shoe press
Capacity increase

CMPC Celulosa, Santa Fe, Chile
Cutter/layboy upgrade

Celulose de Cacia, Cacia, Portugal
Drying machine retrofit

Metsä Board, Husum, Sweden
Rebuild two pulp drying lines

Suzano Papel e Celulose, Suzano (SP), Brazil
Rebuild of PM for fluff pulp production

Celulosas de Asturias, Navia, Asturias, Spain
Wet end rebuild

SCG Paper Excellence Training Center Wangsala, Kanchanaburi, Thailand
IDEAS Simulator-based training
First-of-a-kind high fidelity process simulator to train operators and manage training programs

RECENT START-UPS

COMPLETE LINES AND SYSTEMS

International Paper, Saillat, France
Fiberline modernization

Emami Paper Mills, Balasore, India
300 t/d stock preparation and machine approach system (LWC and coated FBB)

C&S Paper Chengdu, Chengdu City, Sichuan, China
Stock preparation and machine approach system (tissue)

Jiangsu Lee & Man Paper, Changshu, Jiangsu, China
Two-loop deinking system

Shandong Sun Paper, Yanzhou City, Shandong, China
110 t/d NBKP line; 170 t/d LBKP line; 80 t/d incl. machine approach system (tissue)

Hunan Hengan Living Paper, Changde City, Hunan, China
140 t/d NBKP line; 140 t/d LBKP line; 80 t/d incl. machine approach system (tissue)

Karlstads Energi, Karlstad, Sweden
Bubbling Fluidized Bed (BFB) boiler

Växjö Energi Växjö, Sweden
Bubbling Fluidized Bed (BFB) boiler

Hengan Group, Hangde mill, China
Two PrimeLineTM W8 tissue machines with steel Yankees (18 ft. diameter); steam hood; and stock preparation;

C&S Paper Yunfu, Luoding, China
PrimeLineST tissue machine with a steel Yankee and stock preparation

Zhejiang Jingxing Paper, Pinghu City, Zhejiang, China
PrimeLineST C8 tissue machine with steel Yankee; head insulation; steam-heated hood

Shandong Sun Paper, Yanzhou, Shandong, China
Turnkey PrimeLineTM W8 tissue machine with steel Yankee; stock preparation;

LLC Pulp Invest, Kazan, Russia
PrimeLineCOMPACT II tissue machine with steel Yankee; stock preparation; pumps; automation; and electrification

Doubletree Paper Mills, Arizona, USA
PrimeLineCOMPACT VI tissue machine; stock preparation; and automation

Shin-Ei Paper, Fujikawa, Japan
Two PrimeLineCOMPACT V tissue machines

Mondi Syktyvkar, Syktyvkar, Russia
300 admt/d pulp drying machine

KEY EQUIPMENT, UPGRADES, AND MODERNIZATIONS

Celbi Beira Industrial, Figueira da Foz, Portugal
Pulp drying upgrade and upgrade to cooking plant (incl. conversion of competitor's digester to Lo-Solids technology)

Suzano, Suzano (SP), Brasil
New digester for existing fiberline

NEWS

Operator training with a cost focus

The latest development in training tools, based on the IDEAS dynamic process model from ANDRITZ AUTOMATION, is an Operator Training Simulator (OTS) with a unique twist.

OTS has the "standard" features of any good training tool:

- A wide range of scenarios for the operator to train on: start-ups, shutdowns, emergency

situations, disturbances/failures, and even customized scenarios unique to the mill.

- Comprehensive IDEAS Instructor module for managing training competency scores and tracking each trainee's progress and problem areas.

In addition, OTS helps the operator understand the financial impact of operating decisions:

- On-screen display showing relative costs, revenue, and net profit to help the operator understand how his/her actions affect the bottom line.

The first application of the new OTS will be for a multi-mill training program for a large pulp and paper company in Southeast Asia. The simulator utilizes the strengths of ANDRITZ's global network – operator interface design



from Canada, IDEAS models from India and the USA, and assistance from local teams. OTS is available for all the process areas in pulp and paper mills.

Raising the bar in refiner plate performance

Occasionally, a new manufacturing method is so remarkable that the results are clearly superior to conventional techniques. Durabond is an example of this.

Durabond merges laser precision (for tightly controlled narrow bar and grooves patterns) with an innovative bonding technique (for toughness, wear resistance, and smooth grooves) to deliver clear advantages over conventional refiner plates.

High-precision, laser-cut bars of hardened stainless steel are inserted into a baseplate and the surfaces are permanently bonded. This allows the creation of high and narrow bar designs which are

perfect for low-consistency refining applications. The plates work superbly in applications where the temperature is elevated, such as TMP post-refining.

ANDRITZ also developed Durabond Light plate segments (each segment weighs less than 10 kg (22 pounds) and comes with pre-installed bolts and a special tool so that one person can easily attach the segments to the baseplate. Never has changing plates been easier, faster, and safer.

Find more information at www.andritz.com/durabond



High-yield process ready for scale-up

ETHANOL FROM CELLULOSE

ZeaChem has progressed from bench-scale testing to a full demonstration facility for the production of chemicals and ethanol from renewable, sustainable feedstocks. ANDRITZ pretreatment technologies were selected to provide the front-end for ZeaChem's process. We visited the demo facility in Oregon (USA) and walked the ground where a 22 million gallon-per-year (66,000 ton) commercial facility will be sited.

ZeaChem, a biorefining technology company and project developer, follows two basic concepts: *Go where you grow and build to serve.* "For us, this means locating facilities next to sustainable, economic feedstock supplies, and developing projects which produce products that serve customers and their regional markets," says Tim Eggeman, ZeaChem's CEO.

Eggeman is a founder of ZeaChem and co-inventor of the ZeaChem process. He holds a Ph.D. in chemical engineering and at one time worked for Coors Brewing in Colorado. That is where he met co-inventor Dan Verser. The company they founded in 2002 attracted venture capital from well-known backers and received a US\$25 million grant from the U.S. Department of Energy to build a demonstration facility.

Eggeman and Chief Commercial Officer Joe Regnery assert that they can make bio-based chemicals and fuels from sustainable non-food biomass that are cost competitive with fossil fuel-based equivalents.



▲ Brian O'Neill with the "Seed Tank 0" vessel where the first 2 ml of *Moorella* is placed to start the fermentation process.

Although their process works with a variety of feedstocks, ZeaChem is initially focused on woody biomass. "First," says Regnery, "woody biomass is much denser than agricultural residues. This means it can be sourced from a much smaller land area. Secondly, wood can also be stored on the stump and harvested in a just-in-time fashion, reducing harvesting and storage logistics."

Sweet, sweet cellulose

Biomass consists of three main components: Cellulose, hemicelluloses, and lignin. Bio-based chemicals and fuels are produced by breaking apart the cellulosic chain of sugar molecules into single molecules which can then be "digested" by microorganisms. Regardless of the microorganism used, this chemical separation step (hydrolysis) is needed. That is where ANDRITZ comes in.

The "breaking down" is quite similar to pulping, according to Bertil Stromberg, Vice President of Biofuels for ANDRITZ, except that the final objective is different. "In the pulping world, the goal is to preserve the cellulose," says Stromberg. "In biorefining, the goal is to break the cellulose down."

According to Allen Turner, Senior Sales Manager for Biofuels at ANDRITZ, "The concepts of biofuel development have been around, but we are now at a point where there is a very real possibility to make it commercially attractive. This is because of the

Poplar trees at GreenWood Resources tree farm near Boardman, Oregon ▼

advances in developing microorganisms that work effectively and cheaply.”

Small star with big potential

ZeaChem uses a portfolio of microorganisms, yeasts, and bacteria to produce organic acids, ethanol, and derivative products. One star of the ZeaChem show is the *Moorella thermoacetica* bacteria. The *Moorella* bug makes a human hair look like a giant. It ranges in size from 0.4 to 2.8 micrometers (millionths of a meter) while a human hair is about 100-200 micrometers in thickness. What *Moorella* does well is produce acetic acid without producing carbon dioxide. Part of ZeaChem’s intellectual property is the care and feeding of bugs such as *Moorella*. “We create the right environment for the bugs to multiply and do their work,” Eggeman says. “The speed at which they do this is incredible.”

The ZeaChem process

ZeaChem’s patented process converts biomass into concentrated acids, esters, and alcohols. At the Boardman, Oregon demonstration facility, the process starts with wood

chips from poplar trees, a fast-growing fiber source in the Pacific Northwest which rivals the speed of eucalyptus.

The front-end is mostly supplied by ANDRITZ. “Many traditional pretreatment methods are not effective when applied to feedstocks with high lignin content, such as forest biomass,” Turner says. “This is where ANDRITZ has an advantage.”

Pretreatment combines mechanical, thermal, and chemical actions. On the mechanical side, the goal is to achieve uniform size reduction of the biomass. The chemical side removes barriers in the biomass so that ZeaChem’s bacteria and other microorganisms can work their magic during fermentation. Key ANDRITZ equipment includes a live-bottom prestaming bin, a lock hopper, a steam mixing screw – and then the heart of the process, the horizontal pretreatment reactor. The reactor uses ANDRITZ’s advanced dilute acid steam explosion (SteamEx) technology – a two-stage process to heat the biomass, add dilute acid, and then rapidly release pressure.

This causes the water inside the biomass to “explode” the fibers, converting them to very small particles.

The softened cellulose and lignin is “refined” in an ANDRITZ disc mill and the sugar streams from the wood are filtered in an ANDRITZ filter press before being sent to ZeaChem’s fermentation process. The filtered cellulose can be sent through the process again to extract the remaining sugars or it can be sent to ZeaChem bioreactors for enzymatic saccharification before entering the fermentation process.

Microorganisms convert the sugars into organic acids (when using bacteria) or ethanol (when using yeast) during fermentation. In the case of *Moorella*, as little as 2 ml of the bacteria starts the process. From this small “seed,” fermentation is scaled up in a series of tanks to ultimately into three 40,000 gallon (150 m³) fermentation tanks. “The benefit of using *Moorella* is that it just produces acetic acid,” explains Brian O’Neill, Project Engineer at ZeaChem. “This maximizes the conversion of the fermentable sugars to



◀ Pretreatment and hydrolysis equipment at Boardman

ZeaChem’s patented process converts biomass into concentrated acids, esters, and alcohols. This photo shows acetic acid being tested with a gas chromatograph at the lab in Boardman. ▼



◀ (Left to right): Pete Wilhelm, ZeaChem Plant Manager; Zac Mitchell, ZeaChem Commercial Development Manager; Allen Turner, ANDRITZ Senior Sales Manager for Biofuels; and Brian O’Neill, ZeaChem Project Engineer look at a sample of the cellulosic hydrolyzate after hydrolysis and filtering. The next step in the process is fermentation.

bio-based chemical. The carbon efficiency of our fermentation process using *Moorella* is nearly 100%.”

The purified organic acids can be sold (for the production of plastics, solvents, or foams) or converted to esters (for the production of coatings, solvents, and adhesives) or reacted with hydrogen to make alcohols. “We can purchase the hydrogen as we do in Boardman, or we could produce the hydrogen on-site with the addition of a gasifier to process the lignin residue from pretreatment,” O’Neill says.

The Boardman location

Oregon was chosen to be the proving ground for ZeaChem’s facility for a number of reasons, according to Zac Mitchell, Commercial Development Manager at ZeaChem. “First, we found a reliable and economic supply of biomass in the form of poplar trees from Greenwood Resources, a 28,000-acre FSC certified tree farm near Boardman. Next, the plant is located next to a deep-water port on the Columbia River, providing easy access to the Pacific Ocean and major West Coast shipping ports.” The plant is also near Pacific Ethanol’s grain ethanol plant, which gives ZeaChem access to that company’s

marketing, logistics, operations, and maintenance services.

Technology showcase

The demonstration plant has the capacity to process 10 t/d (dry basis) of wood chips and generate up to 250,000 gallons (950 m³) of cellulosic bio-based chemicals or fuels per year. “A key to our success has been in learning how to feed various feedstock materials,” says Pete Wilhelm, Plant Manager. “Once you get the material into the pressurized reactor, the materials react very similarly. But, the density and physical form of the material affects how we convey and feed it.”

ZeaChem is also committed to operating the plant as a “technology institute” open to third parties. “People come to us to test their feedstocks and catalysts, produce cellulosic hydrolyzates for them, or to produce chemicals and biofuels using their microorganisms,” Mitchell says. “It is a huge benefit for them as they move immediately to commercialization without having to invest the time and money to design, build, and operate their own demonstration facility.”

“This work with third parties is also beneficial to us,” Turner of ANDRITZ says. “It serves as

a showcase for our technologies and exposes us to potential customers we may not normally meet.”

Ready for scale-up

The Boardman plant has enabled ZeaChem to demonstrate the process that it will scale-up to produce 22 million gallons (66,000 tons) per year at its first commercial cellulosic ethanol plant to be located right next door. Commercial operations are expected to begin in 2017. ZeaChem was selected for a loan guarantee from the U.S. Department of Agriculture for construction of the commercial plant.

ZeaChem is hoping to be the driving developer for mass production of cellulosic biochemicals and fuels. Globally, the fuel market is extraordinarily large and the bio-chemical markets offer a producer extremely high-value propositions. “Our approach to building true biorefineries will allow access to the most lucrative sectors of these markets in each region where a plant is built,” Regnery says. “The environmental and economic potential is very attractive.”

CONTACT

Allen Turner
allen.turner@andritz.com

PROCESS OPE

Improving operations without capital investments

A service called Process OPE is helping improve the performance of white liquor plants in three of Arauco's mills. The main focus is on reinforcing the best practices for operations, troubleshooting, and maintenance by transferring knowledge from the specialists at ANDRITZ to mill personnel.

OPE (Overall Production Efficiency) is a contract service created by ANDRITZ in Finland many years ago. In its grandest form, OPE involves contract maintenance and process improvement services for an entire production line or a mill. But there are other versions, like Process OPE, which focus on very specific areas in a mill.

"Process OPE has ANDRITZ specialists working side-by-side with mill personnel to reinforce best practices for operations, troubleshooting, and maintenance," says Jari Kapanen, Global Product Manager for OPE services. "It is very much a transfer of knowledge from our experts to mill personnel."

Process OPE has been "exported" for the first time to a customer in Chile – Arauco. What Arauco finds intriguing about the service is not only what it includes – but also what it avoids. Typically, it avoids the need for capital investments to achieve performance improvements.



"New equipment does not guarantee boosts in operational performance," says Harri Soila, General Manager of ANDRITZ Chile at the time and very much involved in the initial discussions with Arauco. "It always comes down to people. Process OPE is designed to improve the skills of some of Arauco's people in a structured way."

Results-focused

Arnoldo Jara, Kraft Mill Service Manager for ANDRITZ Chile, is the Project Leader on the ANDRITZ side. "This is the first OPE Process assignment outside of Europe, and the first in South America," Jara says. "It is an important step for us here and we are closely monitoring the results closely."

It is this "close monitoring of results" that sets OPE apart from traditional training or process troubleshooting, according to Luis Vera, Arauco's Superintendent of Reliability who also serves as the Project Manager for



▲ Jari Kapanen, ANDRITZ Global Product Manager for OPE

this unique project. "Very early, we agreed on how success would be measured using Key Performance Indicators (KPIs). It was very positive for us to see that ANDRITZ is willing to tie its compensation to achieving key results."

Three mills – three bottlenecks

Three of Arauco's mills in Chile – Constitución, Licancel, and Horcones – were selected to be

The Constitución mill: "LOTS OF YOUNGER OPERATORS"

Arturo Jimenez, Mill Manager

"To produce special pulps like 'low kappa', we need more white liquor – so the pressure is always on the white liquor plant not to be the bottleneck.

We burn our CNCGs (concentrated non-condensable gases) in our kiln, and we see more ring formation. This is one of the reasons we take two shutdowns a year (May and October). If we can eliminate the ring problem, we would be fine with one annual shutdown.

When I first heard about Process OPE, I was very interested. One of our challenges here at Constitución is what I call the knowledge gap between veteran operators and younger ones – and we have quite a few younger ones. You see a difference in terms of how the younger operators make more changes to the process. There is a difference in performance from shift to

shift – so this shows that there is a need for better training.

Having our people work directly with ANDRITZ is a different approach for us. The ANDRITZ people are very professional. They do excellent planning and scheduling. And, they have formed excellent relationships with our people.

We don't have many hard numbers yet because the OPE process is still very new. But I know we are heading in the right direction because operations are more stable than they were before. ANDRITZ has suggested some changes and these changes are working.

I like the OPE approach. We need to do similar work in other recovery areas since we are recovery-limited. I am looking forward to continuing."



▲ Arturo Jimenez, Mill Manager



▲ OPE status meeting at the Constitución mill

part of the first Process OPE project. More specifically, the three white liquor plants. "We had similar situations at each mill," Vera explains. "When analyzing reliability issues, we identified several with white liquor plant performance – older equipment, some younger operators, ring formation in the kilns, stability issues, etc. This all contributed to the white liquor plants becoming bottlenecks at all three mills."

According to Vera, the traditional way for Arauco to solve such a problem would be to call in a supplier or outside expert to fix it. "But, when the experts left, the knowledge left with them," Vera says. "With OPE, the knowledge is being transferred inside our mills and the follow-up occurs by our own people. This gives us a repeatable process to avoid duplicating problems."

Arauco views the white liquor plant Process OPE as a pilot program. The concept was presented to all mill managers and they are watching closely. "If we achieve success in meeting the critical KPIs," Vera says, "we will extend the work to other process areas and other mills."



▲ Michael Krainz, General Manager of ANDRITZ Chile, participated in the steering committee meetings with Arauco for the OPE project.

The one-year Process OPE project was kicked off in 2014. KPIs for each mill were identified (such as improvements in equipment availability and in white liquor quality). ANDRITZ then performed a thorough process analysis at each mill. For this phase, two top ANDRITZ white liquor plant experts from Finland, Pertti Ronkanen, Senior Process Specialist, and Jari Pääkkönen, Process Engineer, were brought in.

"Our first Process OPE contract outside of Finland was in Austria on a white liquor plant," Pääkkönen says. "The equipment was fairly new, but the customer wanted to achieve all of the maximum values. Most mills running well don't even think about OPE, even though there is always an opportunity to raise performance."

The Licancel mill: “IT PUTS US IN CONTROL”

Alvaro Mancinelli, Mill Manager

“This is a small, but special mill in that we are flexible. We produce bleached and unbleached, hardwood and softwood. Production is about 450 t/d.

We are pushing for more production here. Many of these pushes require a change in the way our equipment is operated. There is a huge difference between operating a white liquor plant, and optimizing it.

In the past, when we had a process problem, we would call a process consultant. That person would come to the mill, analyze the problem, and hand us a report. Very little knowledge was transferred to our people.

We decided to try ANDRITZ OPE because it is focused on leaving knowledge here with our operators. The hope is that next time we will solve the problem internally. I think that it's a better approach.

We need to have tighter control of our processes to reduce variability. But tighter

control requires deeper operator knowledge. This investment in training is every bit as important, perhaps more so, than investments in equipment.

We used to have to shut down the kiln about three times a year to blast the ring formation. Now we are trying new practices and procedures that have helped. In the short time that ANDRITZ has worked with us, we have improved our recausticizing process and the lime mud precoat filter. ANDRITZ has helped us tune these things to higher levels of performance.

When operators see the improvements, they are anxious to do more. ANDRITZ people have a good way of explaining things – not making operators feel embarrassed for asking questions.

Instead of a one-time fix from an outside consultant, we now have ANDRITZ OPE experts working with our operators many times, so that the operators don't forget and it becomes routine.”



▲ Alvaro Mancinelli, Mill Manager



▲ Pertti Ronkanen (left), ANDRITZ Senior Process Specialist, with Cesar Gonzalez, Arauco Process Engineer

Focusing on root causes

And now, the concept has spread to South America. “The work here is different, as the equipment is not new – but the approach is the same,” Päykkönen explains. “A customer has a problem, and has ideas on what is causing the problem. Our value as equipment and process experts is in being able to focus the customer on the root cause of the problem. In many cases, this is further upstream than where the customer was initially focusing.”

For example, one root cause of Arauco's kiln issues was the variability in green liquor density. “Control of the green liquor coming from the recovery boiler varies considerably,” Päykkönen says. “It is virtually impossible to



▲ Luis Vera, Arauco Project Manager for Process OPE

stabilize the white liquor plant with fluctuations in incoming raw material quality. We also recommend that Arauco move from the old-style,

single-loop control of density to the three-loop control that modern mills use.”

For his part, Ronkanen works side-by-side with operators to improve basic control of the recausticizing process, such as monitoring temperatures of the slaker and the green liquor to control lime additions. “With Process OPE, all the changes are made by operators and maintenance people, not by us,” Ronkanen explains. “We discuss and train people on new ways of operating, but the actual decisions and work are carried out by mill people.”

The training sessions are very small, maybe three to four operators with one ANDRITZ

The Horcones (Arauco) mill: “OPPORTUNITY TO OPTIMIZE”

Mario Vergara, Mill Manager

“Our first production line began operating in 1972, and our second line started in 1991. The white liquor plant, with few exceptions, is operating with the same equipment that was installed 24 years ago. The maximum capacity of the plant is 4,600 l/min of white liquor and 455 t/d of lime.

Considering that ANDRITZ has a depth of experience in the recausticizing and kiln area, we were very open to hearing about their OPE concept. We felt that the approach would blend well with our style of interaction and feedback and would be a good opportunity to optimize our white liquor plant operations. I should point out that while we have some ANDRITZ equipment in both of our production lines, they are not the major equipment supplier.

Our white liquor plant is the process area with the most issues and the most disturbances. Ring formation in the kiln, for example, forces us to stop production of Line

#2 too often. In addition to the kiln, we have a bottleneck in producing enough high-quality white liquor for our digesters.

The main benefits that I have seen so far with Process OPE is the diagnosis and identification of the main points to be optimized. We are following these points quite closely and deviations are being dealt with in a timely fashion.

Our operators in the white liquor plant range have between one and 21 years of experience. They all, young and old, have increased their knowledge considerably through training provided by ANDRITZ. The coordination and cooperation has been good between both parties. I have observed improvements as the project progresses through its different stages.

I appreciate the company for its expertise, having good professionals with a good level of specialization.”



▲ Mario Vergara, Mill Manager



▲ Kiln at Horcones mill

instructor. The work is conducted in the control room using the DCS screens. Topics focus on practical matters: operating the equipment using key tests and critical setpoints, understanding how each adjustment can affect the overall results, and troubleshooting.

“Good work is being done”

“When I first heard about OPE, I was a little nervous,” Vera admits. “I thought that maybe the pressure to achieve KPIs would lead to pointing fingers and blaming each other for not achieving results. Now, as the project progresses, I am not so worried. We are all working together, cooperating to reach the same goals. Good work is being done.”

In the diagnostic phase, certain equipment was identified that was not operating correctly – the continuous precoat renewal filter and sludge press for example. “We have rebuilt the equipment and made adjustments to make sure this equipment operates at the correct levels,” Vera says.

“OPE is a systematic way to improve process availability,” Vera explains. “Several process trials have shown the importance of systematic development. Actions and results have been monitored continuously. The results are followed by a steering committee of Arauco and ANDRITZ managers on a quarterly basis. This committee prioritizes actions based on needs and desired results. We are on the right track.”

CONTACT
Allen Turner
allen.turner@andritz.com



▲ Estefania Schettino (left), Arauco Process Engineer, with Angelo Villalobos, Field Operator at the Horcones mill.



▲ Kevin Liu, General Manager,
Sun Household Papers

Decisions at the speed of

LIGHT

With the agility of a private company and the courage to take bold decisions, Sun Paper is expanding into the tissue and hygiene sector. We talk with Kevin Liu, General Manager, to gain perspective on this business decision, and Guangdong Ying, VP and Chief Engineer, to learn about the selection of ANDRITZ as a key technology partner.

Sun Paper is one of the largest private enterprises in China, active in many areas besides pulp and paper, where it ranks among the world's Top 100 paper companies. The headquarters are in Yanzhou, Shandong Province, the hometown of Confucius, a philosopher who emphasized morality, social relationships, justice, and sincerity. If you add to these qualities the emphasis on "speed of decision-making" and "strength of commitment," you have a good profile of the modern-day Sun Paper.

Speed, but with purpose

"Just so you understand, we do not equate speed with carelessness," explains Kevin Liu, General Manager of Sun Household Papers. "We decide upon a strategy, identify the opportunities, and then move fast. At what I like to call the speed of Sunlight."

Unlike paper companies making grade conversions in order to survive, Sun Paper is entering the tissue business from a position of strength. Well known for packaging products and printing/writing grades, Sun Paper is focused on getting a share of China's growing tissue consumption (now about 4.4 kg per capita compared to 11-16 kg in Europe and 23 kg in the USA) as well as consumption of diapers, disposables, etc.

Latecomers can have advantages

Liu has extensive business experience and a consumer's perspective. He started his career in international trade in China, moved to the USA where he worked and earned a master's degree in business administration (MBA), then returned to China to work in the tissue business with APP and April. He joined Sun Household Papers in March 2013.



▲ Guangdong Ying, Vice President & Chief Engineer,
Sun Paper



▲ PrimeLine™ W8 machine with PrimeDry Steel Yankee and PrimeDry ReEvaporation system for heat recovery

While he admits that his company is “a latecomer to tissue,” Liu sees this as an advantage. “We don’t have to upgrade old machines and converting equipment to get the newest and best technology,” he says. “We are also motivated to do things better than our competitors.”

Thinking backward

Part of “doing things better” is looking at the business from the consumer point of view. “With consumer products, it is all about the brand experience,” Liu explains. “We focus on the touchpoints where consumers interact with our company and our products. This is different to commodity industrial products, where production efficiency is the focus.”

To this end, Liu and his team have “thought backwards” through the value chain. “The critical elements are building the distribution network and the brand,” Liu says. “The easiest part for us is to actually manufacture the product.”

While the installation of tissue machines and converting lines is something new for Sun Paper, and for Guangdong Ying, Vice President & Chief Engineer for Sun Paper Industry, it is not so new and different as to be a problem. Ying is responsible for technical, engineering, and project direction for all of Sun Paper’s assets.

“There are definitely new things to learn with tissue,” Ying admits, “but we have in-depth experience in papermaking. We started making paper over 30 years ago on one second-hand machine making one tonne per day. Today, we have a total capacity of about four million tonnes of paper, and we have 26 machines at the Yanzhou mill site alone.”

First two machines: ANDRITZ

The selection of ANDRITZ as supplier of the first two tissue production lines (including stock prep, machine, automation, and pumps) was seen as a risk-free choice for Sun Household Papers. “ANDRITZ has a

first-mover position in China,” Ying says. “It was the first, and has the best technology for tissue in China. The machines fit the Chinese market and our requirements perfectly.”

The first ANDRITZ PrimeLine™ machine was started up in June 2014. The second machine was brought online in April 2015 after only three weeks commissioning. Full production began immediately, and saleable tissue has been produced from the very beginning.

According to Bai Bingchen, ANDRITZ China Vice General Manager for Tissue, the PrimeLine™ W8 machines are designed for a speed of 2,000 m/min. Each machine is equipped with a PrimeFlow 2-layer headbox, including dilution control, and a PrimeDry Steel Yankee with a diameter of 18-feet (5.5 m). “We delivered the complete stock preparation plant, machine approach, and automation (distributed and quality control systems), as well as all the stock pumps and agitators,” Bingchen says.

“The configuration really fits our needs,” Ying says. “The CrescentFormer gives us the desired bulk and smoothness, and the Steel Yankee helps us save energy. We will manufacture in the range from 12.5-45 gsm, but our focus at the moment is on bathroom tissue at 15.5 gsm.”

Ying commented on the PrimeDry ReEvaporation system, which uses waste heat to evaporate condensate. “This form of heat recovery returns potentially lost energy to our process, and the condensate goes back as steam to the Yankee,” he says. “Up to 30% of the steam demand for the drying process can be generated from waste heat.”

For efficiency, Sun Paper matched the width of the ANDRITZ machines (5.62 m) with their converting line (2.81 m). “This reduces our waste by about half of the industry average,” Ying says. Sun Household Papers was the first to install fully automatic converting lines. Installation was completed before the tissue machines started up so the company could use parent rolls purchased from Chinese suppliers who owned ANDRITZ machines with similar configurations. “This way, we could launch our brand with a product that would have very similar quality to our own machine,” Liu says.

An amazing start-up

The plan was to have paper on the reel on June 18, 2014, but ANDRITZ was able to beat this date by about a week. “It was a tight schedule,” Bingchen of ANDRITZ says. “We had 14 months from contract signing to start-up. This installation at Yanzhou set a new record for fast start-ups in China by ANDRITZ tissue machines.”

Ying called the start-up “just amazing” in that there were only 140 tonnes of off-spec paper produced. “Since then, everything has been uniform quality and saleable,” he says.

“ANDRITZ technology is the best in China now,” Ying explains. “We certainly made the right decision. This technology provides us with stable production, delivers the right quality, and allows us to focus on the market – not on production problems.”

Consumer is first to touch

Sun Household Paper’s goal is to have at least 100,000 retail stores selling its products in the Shandong region. “We are moving at the speed of Sunlight to make that hap-

pen,” Liu says. “To go national, there are over 2,500,000 stores in China. We have very ambitious goals.”

“We maintain very high standards for clean production, including a clean environment,” Liu says. “Due to the degree of automation, the consumer is the very first to touch our product.”

The company’s brand is supported by the theme: Clean in the hand, warm in the heart. “We don’t just use our brains, we use our hearts to make the right product,” Liu says. “This may sound strange to some Westerners, but it is absolutely true. We will be a substantial competitor. I invite you to come back in a year and see how we have progressed.”

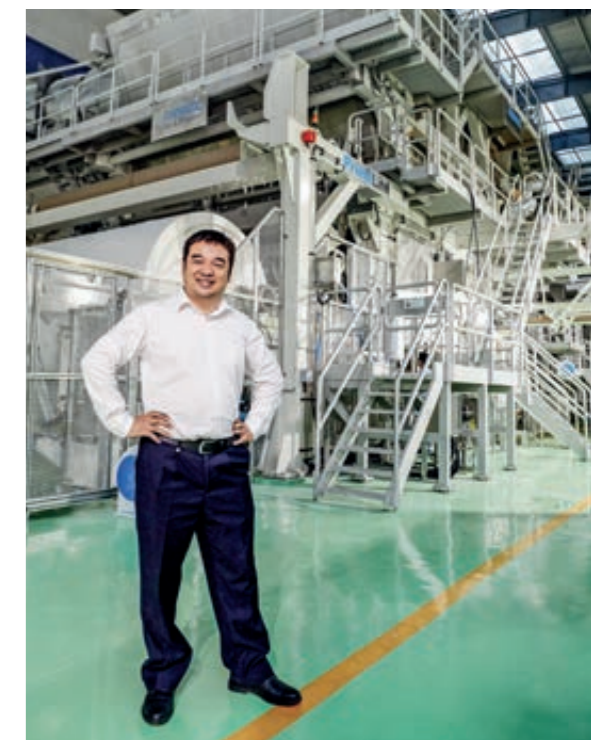
The speed of light is 299,792 km/s. The speed of Sunlight might be even faster. We are looking forward to coming back.

CONTACT

Tissue machines:
Günter Offenbacher
guenter.offenbacher@andritz.com

Hongwei Tang
Production Manager, Shandong Sun
Paper Industry ▶

Sun Elements brand of facial tissue ▼





▲ Zedivap effluent evaporation unit for zero effluent from the mechanical pulping line

Perfectly matched fiber production

"When we started with PM1 in 2001, our fiber requirement was 150,000 t/a," says Guangdong Ying, Vice President & Chief Engineer. "In a little over 10 years, the requirement was 1.6 million tonnes. So we needed a lot of good quality fiber. For the high-quality papers we produce, we have focused on our own high-quality virgin wood pulp production."

This focus has enabled Ying to become quite familiar with ANDRITZ over the years. "We have had long and good cooperation with ANDRITZ since installing their first APMP system in 2006," he says. "Today at Yanzhou, we have four APMP lines in this mill alone, producing over 1,900 tonnes of pulp per day (over 600,000 t/a)."

The ANDRITZ Alkaline Peroxide Mechanical Pulping (APMP) process with chemical pre-treatment has proven to be "perfect for plantation poplar, acacia, and eucalyptus," according to Ying. The P-RC APMP process (pre-conditioning followed by refiner chemical treatment) splits the application of alkaline peroxide between chip impregnation and bleaching right after the primary refiner, which results in better chemical utilization and improved properties of the pulp.

Sun Paper's first P-RC APMP line had a capacity of 300 t/d for board grades. "Shortly after



▲ High-consistency refiners in the newest P-RC APMP line at Sun Paper, Yanzhou

ANDRITZ finished the first line, we signed up for a second P-RC APMP line with almost double the capacity at 550 t/d," Ying says. "Today, that line is operating at 20% higher capacity with only a couple of small upgrades."

A third line, with a design capacity of 431 t/d, was ordered in 2010. This system design allows flexibility to produce pulp for both board and paper grades, coated and uncoated. The fourth line, the largest of all at 650 t/d, was ordered in 2012 for the production of board grade pulp.

"We have had very good projects with ANDRITZ, also at the speed of Sunlight," Ying says. "One project was the fastest mechanical pulping project ever executed, with installation, start-up, and ramp-up at a world record pace. The time it took to achieve performance guarantees was about three weeks from start-up."

Ying cites the advantages of the ANDRITZ MSD Impressafiner, "which gives us really good fiber." For the pulping lines producing furnish for paper grades, "we use two stages of refining and bleaching to make the higher quality pulp with higher brightness."

Like all the paper companies in China, Sun Paper is shifting from a growth mode to an efficiency mode, according to Ying. "We have worked with ANDRITZ's R&D people at their laboratory in the USA to reduce chemical consumption and energy significantly. Recently, we ran trials to test ANDRITZ's latest APMP development for further reducing energy consump-

tion. The trials showed that, although we are quite low with our power consumption, there is still potential to go lower thanks to the newest ANDRITZ technology."

Evaporation of effluent

To virtually eliminate effluent from the mechanical pulping lines, Sun Paper chose to install Zedivap effluent evaporation systems from ANDRITZ. The Zedivap units are based on Mechanical Vapor Recompression (MVR) technology that uses a compressor (low-rotation speed turbo fan) to increase the pressure of the evaporated vapor – allowing it to be used as a heating medium in the process.

The Zedivap extracts water from the effluent in the APMP process. The condensate is treated and returned to the APMP process, significantly reducing total water consumption. The residuals are further concentrated and incinerated in the mill's evaporators and recovery boiler.

Sun Paper's Zedivap units are the first in China to be used in this way for the wastewater system. This process represents modern and sustainable technology for effluent treatment. "With the evaporation units from ANDRITZ, we get very good results," Ying says. "There is a significant reduction in COD, and we are only consuming 6-7 m³ of water per tonne of pulp."

CONTACT
Fiber preparation:
Markus Pichler
markus.pichler@andritz.com

NIPPON KUSHIRO

—
diversifying with
rayon pulp



Nippon Paper Group, one of Japan's largest paper producers, has 20 mills in Japan and extensive overseas operations. For years, dissolving pulp was produced only at the Gotsu Mill, using a batch process. The decision to employ a continuous process for dissolving pulp at the Kushiro Mill was a bold decision. ANDRITZ aided in the pulp line conversion.

Nippon's Kushiro Mill, located on Japan's scenic north island, has a long tradition in pulp and papermaking. Since 1920, it has been a leading newsprint supplier. From 1970 to 1990, pulp production and pulp sheet capabilities were expanded. The most recent investment centers around modifications to the continuous cooking line so it can swing between producing softwood kraft and dissolving pulp. The key to Nippon Paper's strategy for long-term sustainable growth is diversity, which production of another pulp grade provides and which also includes energy generation for the local community.

"Producing dissolving pulp from softwood makes sense for us because we were already producing bleached kraft pulp in a continuous digester," says Kazufumi Yamasaki, Executive Director of Technology in the R&D Division of Nippon Paper. "Working closely with ANDRITZ, we decided to be the pioneers in a swing system. The twin vessels (an ANDRITZ pre-hydrolysis vessel and the continuous digester vessel), plus a streamlined chip feeding system, make this possible."

Kazufumi Yamasaki, Executive Director of Technology in the R&D Division of Nippon Paper (left) with Chiaki Kawakami, President of ANDRITZ Japan, near Nippon Paper's headquarters ▶



Nippon Paper's Hisashi Ochiai, Technical Manager, Production Department (left) and Takuya (Tak) Yamamoto, Pulp Engineering Manager, played important roles in optimizing the new dissolving pulp system. ▼



Examining ladies garments made from dissolving pulp rayon blended with cotton and polyester are Takehiro Kojima (left) and Takaoki Yanagiya (center) of Nippon Paper with Sawada Reiko of ANDRITZ Japan. ▼



Kushiro's digester was the world's first vapor-phase upgrade back in 1996. It was modified to run Lo-Solids Cooking almost two decades ago. The pre-hydrolysis vessel (PHV) and supporting systems were installed in 2012.

Removing the hemis

For the production of dissolving pulp, a pre-treatment step is required to remove most of the hemicelluloses in the wood to achieve extreme pulp purity. Otherwise, the hemicelluloses will precipitate during the rayon production process, plugging up the filament spinners.

Takuya (Tak) Yamamoto, Pulp Engineering Manager at the mill, says, "Dissolving pulp can only achieve high purity when the hemicelluloses are effectively removed. At our mill, this begins in the PHV by adding hot water to softwood chips under high temperature and pressure. This starts the auto-hydrolysis reaction and most of the hemicelluloses are removed."

Smooth feed with TurboFeed

The ANDRITZ TurboFeed system is considered ideal for integration with the pre-hydrolysis vessel as it helps stabilize the flow of chips to the process. Chips are heated and deaerated in the chip bin, then pumped to the PHV with three TurboFeed pumps. To help reduce

energy costs, the process steam for chip heating comes from a reboiler.

"One of our biggest challenges was to stabilize the chip level in the PHV," comments Hisashi Ochiai, Technical Manager in Nippon's Production Department. "The flow of chips impacts the chip retention time, which impacts the quality of our pulp. That is why we worked closely with ANDRITZ to focus on keeping the chip flow and production rates constant. We are still adjusting the system, and coming much closer to the desired objectives."

"Whenever you do something entirely new, there are some surprises," says Tatsuo Ishii, Project Engineer with ANDRITZ. "The good surprise is that softwood pulp is versatile and can meet Nippon Paper's needs for entirely different products. The challenging surprise has been regulating the movement of chips within very tight specifications. This called for some mechanical and instrument refinements."

Swing finesse

Swing production between kraft and dissolving is facilitated by the PHV bypass line at the third chip pump outlet. In order to avoid mixing softwood kraft and dissolving pulps, drain lines are switchable for both acidic and alkali

conditions. Kushiro's process control system activates the bypass. Everything is under control and relatively easy to manage, since the modified digester and other equipment operate nearly the same as before when the mill was producing only kraft pulp.

"Smooth transitions are essential to a mill's productivity and efficiency," notes Chiaki Kawakami, President of ANDRITZ Japan. "The PHV integrates well with the existing line. The beauty is that the same softwood pulp is handled in different ways to meet entirely different objectives. Nippon Paper has the flexibility to adapt to the marketplace to satisfy their customers. We are proud to have helped pioneer this system."

PHV made in Japan

The PHV technology was developed by ANDRITZ for hemicellulose removal in a continuous cooking process. The PHV ensures more stable production and pulp quality at a lower operating cost than a comparable batch process. For the Kushiro Mill, the PHV was built in the far south of Japan in Yatsushiro City, Kumamoto Prefecture. It was delivered to the mill in five sections. Erection of the 35 m high vessel went smoothly from start to finish.

Due to space limitations at the mill, Kushiro's PHV is located 40 meters away from the existing digester vessel. For this reason, a booster chip pump was installed between the PHV and the digester.

Operational status

Erection and mechanical construction was completed in September 2012, and chips began feeding for kraft pulp production in October 2012. The first dissolving pulp was shipped to customers in March 2013 after test runs and fine-tuning. Consistently good efficiency has been achieved ever since.

Says Hisashi Ochiai of Nippon, "In our early evaluation, we were concerned about possible scaling, but these issues have essentially been resolved. During the downstream processes, we pay attention to chemical additions to keep the pulp viscosity at a targeted level. Other than that, nothing has occurred that changes runnability significantly compared to the production of kraft."

Long-term sustainability

Nippon Paper is approaching the 100-year milestone in pulp and papermaking. Daily operations are viewed in context of a bigger picture. As Tak Yamamoto puts it, "Situated in

a seaside city, we are conscious of fishermen and ocean life. We support the well being of rare red-crowned cranes, which migrate to and from the largest wetlands in Japan. We have high standards for logging and transport of local softwood from managed forests. We sponsor many community environmental programs in our region. Our name itself shows support of the Nippon Cranes professional hockey team, and we are big supporters of youth hockey. We are part of the community, and always seek ways to be job providers and good citizens for the long-term."

From a corporate viewpoint Kazufumi Yamasaki concludes, "Nippon Paper uses its resources in increasingly diverse ways, exploring all the possibilities of wood and creating new value to meet the needs of society."

** Special thanks to Yoshifumi Horisaki, Manager of the Pulp Section of the Kushiro Mill for contributing technical details about the functionality of the dissolving pulp system.*

CONTACT
Hannu Råmark
hannu.ramark@andritz.com



▲ Referred to as the "Dinosaur," the Lo-Solids digester is an icon in the Kushiro landscape.

Fast rebuild
and fast acceptance

A RUSSIAN GAME- CHANGER

The rebuild of the K-28 paper machine for Naberezhnye Chelny in Russia was executed and accepted in record time. From the second reel on, the paper quality was of consistently high quality and very saleable. The General Director of the mill said that the speed with which the rebuild was accomplished was dictated by the changing requirements of Russian customers. Another example of overcoming challenges, working in close collaboration, and achieving record results.

In the heartland of Russia, 800 km east of Moscow, is the Republic of Tatarstan. Located alongside the Kama River is the small yet thriving city of Naberezhnye Chelny, home to Naberezhnye Chelny Board & Paper Mill (KBK).

KBK has two machines – one for the production of tissue and one for the production of packaging grades. In 2012, KBK decided to make an investment to rebuild and upgrade the wet end and press section of its K-28 board machine. “We wanted to increase our quality, machine efficiency, and production throughput,” says KBK’s General Director, Vladimir Bestolkov. “Since this was going to be the largest investment in this mill’s 33-year history, we took the decision regarding the equipment supplier very seriously.”

During the tender period, the KBK management team assessed the various industry players, locally and abroad, to determine who could embrace this challenge and deliver the best payback. “We opted for ANDRITZ based on the company’s experience, reputation, and knowledge,” Bestolkov says.

The benefits and results have been nothing short of remarkable. “I am proud of the work our employees did, working in very close cooperation with ANDRITZ,” says Bestolkov proudly. “The time period from shutting the old machine down to starting up after the rebuild was a quick 45 days, which is truly a game-changer in the Russian pulp and paper industry. Plus, we had saleable paper from the second reel on.”

The rebuilt machine was started on August 28, 2014. Post upgrade, machine speed increased 27% (470 to 600 m/min) and capacity was boosted 21% to 190,000 t/a on this two-ply machine with a working width of 4.25 m.

The “usual” pressures: time and money
Making the right investment choices is not an easy task. KBK’s rebuild project had to succeed in order for the company to be well positioned for future market growth. With a growing demand for packaging and tissue, the company is in the right niches (it produces packaging and hygiene products). “Our products are sold throughout Russia and demand continues to grow with a current market share for board-based products of 7.5% and hygiene products of 17%,” says Andrey Fomichev, Deputy General Director.

In terms of raw materials, KBK is moving in the green direction. Furnish is virgin pulp for hygiene and kraftliner products; OCC recycled fiber is delivered from various regions of Russia, with 10% coming from Tatarstan.

“After signing the contract in late 2012, the pressure was on all of us to meet the projected deadlines and keep within budget,” notes Fomichev.

Strategic and detailed planning
A machine rebuild of any magnitude requires detailed planning to reduce the shutdown

time and close cooperation on-site in order to succeed. Since ANDRITZ was supplying the main technical components as well as supervision of the erection, commissioning, and start-up, detailed handoffs had to be planned for. “For our part, we did detailed planning to ensure that all the components and specialized tooling would be on-site for the shutdown beginning the end of June 2014,” says Klemens Unger, ANDRITZ Project Manager. “Everything had to be in place so that the erection team could carry out its assignments without delay.”

The ANDRITZ delivery included the machine approach system, pumps, two-ply wire section with new headboxes and dilution control



“The time period from shutdown to start-up after the rebuild was a quick 45 days – truly a record in the Russian paper industry.”

Vladimir Bestolkov
KBK’s General Director

and a press section with shoe press in the second nip. In addition, according to Unger, "We also supplied the *PrimeFeeder* threading system from the press section to the drying section, *PrimeRun* web stabilizers for the machine's single-tier dryer section, the machine drives, the Quality Control System, the Distributed Control System, and the machine drives, and the Motor Control Center for our scope of supply."

The old wire section of K-28 had seven vacuum formers, but now has two wire tables. "We opted for the *PrimeFlow* SW headboxes with dilution control since they are technologically state-of-the-art," says Mikhail Nokhrin, Chief Engineer. "The lamella design inside creates excellent formation, fiber distribution, and

paper profiles. The *PrimePress* X significantly improves dewatering and saves us energy. Because of this, we could get the increased production without rebuilding our drying section."

Unforeseen challenges

KBK, with its professional leadership, was meticulous and focused on garnering the best results from the project. "Certainly we faced challenges," says Unger of ANDRITZ. "In any rebuild, you need to be flexible to adapt your technical solutions if required. For example, a detailed study of the existing foundation concluded that it would not be sufficient to carry the static loads created by machine clothing replacement. Together with specialists from a Russian construction company, we developed

a solution to reinforce the existing foundation and adapt the construction of the machinery beams to avoid the expense and time delays for making a completely new foundation."

Language barriers, geographic distances, and the complexity of preparing documents for Russian customs clearance were also challenging at times. "We all entered this project with a team spirit and a common goal," says Unger. "The ANDRITZ and KBK teams united seamlessly on all levels to meet the deadlines and KBK's expectations."

A conclusion and a new beginning

K-28 was restarted in its new configuration and saleable paper came quickly. So did the final acceptance.

“By including ANDRITZ’s technologically advanced solutions, we have increased speed, increased production, increased quality, and increased machine efficiency.”

Andrei Fomichev
Deputy Director General



◀ New press section after the rebuild



(l-r) Sergey Gavrilov, Board Production Manager; Ivo Valtchev, ANDRITZ Sales Manager; Klemens Unger, ANDRITZ Project Manager; Andrei Fomichev, Deputy Director General; Sergey Poteryaev, Deputy General Director for Production; Mikhail Nokhrin, Chief Engineer; Vladimir Bestolkov, General Director; and Georg-Michael Sautter, ANDRITZ Senior Sales Director. ▶



▲ Photo shows part of the new top former in the wire section. The original machine had multi-layer forming on seven vacuum formers.



▲ KBK's end product – boxes for Russian production.

"By including ANDRITZ's technologically advanced solutions, we have increased speed, increased production, increased quality, and increased machine efficiency," says Fomichev. "Productivity has improved by a large measure due to the sheet formation, web stabilization, and the closed draws between wire and press, and within the press section. Sheet breaks are a rare event now." March 17, 2015 became a noteworthy day when KBK management signed the Final Acceptance Certificate (FAC) with ANDRITZ. "Seven months from the start-up of the new and improved K-28 and we have formal acceptance," says Georg-Michael Sautter, Senior Sales Director for ANDRITZ. "This is a record in itself, being the fastest achieved for such a complex rebuild project in Russia."

Although the project is concluded, it is not intended to be the end. "I have mixed emo-

tions, Sautter says. "The business negotiations were tough, but we have also established strong bonds and solid friendships. The cooperation has been truly remarkable."

With the second stage of KBK's modernization plans now concluded, a third stage is anticipated during 2016 - 2020. "Our goal is to optimize the machine to achieve 800 m/min with stable quality parameters, which will increase production to 250,000 t/a," says Bestolkov. "ANDRITZ delivered what they promised. Any time we faced a technical hurdle, we found a working solution. This is a valuable asset that ANDRITZ people possess. We will strongly consider partnering with them in the future."

Collectively committed and responsible

KBK is one of the few employee-owned enterprises in Russia. "We are committed to the 1,717 employees here," Bestolkov ex-

plains. "My predecessor, General Director Titov, had a vision 20 years ago regarding the ownership structure. He had housing built for employees and their families near the mill." KBK has also built two kindergartens and a school, and sponsors sports activities, charity and social events, and other activities.

In September 2014, the mill was visited by the President of Tatarstan, Rustam Minnikhanov, together with various Ministers of the government to witness the ANDRITZ upgraded K-28 in action producing linerboard. President Minnikhanov was impressed by what he saw at the enterprise. "Today we have seen the fruits of modernization," he said. "You are a good example for other companies."

CONTACT
Georg-Michael Sautter
georg-michael.sautter@andritz.com

Fujian Liansheng is the largest packaging producer in Fujian Province. With eight machines, it manufactures nearly three million tonnes of paper and board products each year. Moving from linerboard and grey-back board products to higher margin white-top and coated grades, Liansheng needed a higher level of stock preparation. The selection of ANDRITZ technology fits perfectly.

New whiter product

HIGHER PERFORMANCE



▲ Overview of Fujian Liansheng's new stock preparation system, including deinking.

The newest machine at Fujian Liansheng, PM8, is quite impressive. With a capacity of 600,000 t/a, the 6.6 m wide machine produces very high quality coated board, white-top testliner, and other packaging products.

The machine, located at the company's mill in Longhai, Zhangzhou City, went online in 2014. Since it was the first machine to produce white-top grades, the selection of the stock preparation technology was a critical decision for mill management. Xue Rongjun, Vice General Manager, led the team to do the technical evaluations and was project director for the new machine.

Xue Rongjun came to the mill in 2001. He is responsible for production, technical, and project management and graduated with a

degree in pulp and paper manufacturing and management. "This is our first experience with producing white-top packaging grades and our first experience with deinking technology," he says. "We compared offerings of several competitors, visited reference sites, and concluded that ANDRITZ technically and commercially had the best solution. Their DIP systems have very good market references both in China and around the world."

Brown to white

Fujian Liansheng entered the paper industry in 1999 and its first paper mill was built in 2004 in Zhangzhou City. It has two major production sites. The newest, Longhai, was opened in 2006. Longhai is located very close to Xiamen, a major city in Fujian Province on

the southeast coast of China with a population of 3.5 million people, and a good source for the recycled fiber the mill depends upon. In total, the Longhai mill processes 2.5 million tonnes per year of wastepaper, about 60% of which is imported. All of this furnish passes through two ANDRITZ FibreFlow drum pulpers at the site.

The Longhai location is an extensive production site encompassing over 76 ha and housing four machines, a large and extensive operation for processing recycled fiber, wastewater treatment, and its own power plant which provides ample electric and steam energy to match production.

"The site here includes living areas for our workers," Xue Rongjun says. "The living

area includes dormitories, dining room, recreational centers, garden green space, and other features to provide a comfortable place for workers when they are not in the mill."

Fujian Liansheng's traditional products have been paperboard, grey-back board, corrugating medium, and other varieties of brown products such as bobbin paper, core board, and testliner. After producing about two million tonnes of brown packaging grades, the company has added capacity for producing coated board and white-top liner.

Long-term relationship

"We have had long-term cooperation with ANDRITZ and we know each other very well," Xue Rongjun says. "My first personal experience with ANDRITZ was in 2007 when



"This is our first experience with producing white-top packaging grades and our first experience with deinking technology."

Xue Rongjun
Vice General Manager

ANDRITZ supplied the machine approach, new headbox, size press, and calender for our PM2 testliner machine."

Jiang Weiqiang, ANDRITZ's Vice General Manager of Sales for pulping and fiber products in North China, recalls the project and some of the previous work. "We started by supplying a screen room for PM1 (2006) and approach systems for PM2, PM3, and PM4," Jiang Weiqiang says. "Later, there were projects to supply the stock preparation and approach systems for PM5, PM6, and PM7, and also the complete stock preparation and approach flow for PM8. Today, we can say there is ANDRITZ technology in the stock preparation areas for each of Fujian Liansheng's eight machines."

"ANDRITZ has good market references and the quality and performance of their systems are well documented," says Xue Rongjun. "Most of the equipment for our mill is now manufactured here in China (ANDRITZ Technology Center in Foshan). Of course, price is important, but we focus on performance here. The equipment must perform as specified and be reliable."

Virtually no problems

The newest machine, PM8 can produce four plies with the top layer being white coated. It operates at about 1,000 m/min. The basis weight range is 170-450 gsm. Much of the production is utilized for the packaging of tissue products or food items, such as coffee, because of the high-quality white layer for printing.

Three of the four layers of the coated board are processed by new ANDRITZ stock preparation systems. Furnish for the top layer is virgin kraft. ANDRITZ supplied a 250 t/d fiberline to process the bleached kraft pulp for the top ply.

Furnish for the under-top layer is Old Magazines (OMG) and Mixed Office Waste (MOW). ANDRITZ supplied a 350 t/d line for

processing these raw materials, including a deinking (DIP) plant.

The back layer consists of Old Newsprint Pulp (ONP). ANDRITZ delivered a 260 t/d processing line for the back ply.

These three layers account for about 65-70% of the board's total grammage. The remaining basis weight is supplied by a filler layer which is primarily Old Corrugated Containers (OCC). ANDRITZ provided some components for the 1,300 t/d line processing the filler layer.

In addition to the stock preparation equipment, ANDRITZ delivered a four-layer machine approach system, under-machine broker pulpers, a save-all filter, sludge de-

watering equipment, and rejects treatment systems for the three recycled fiber lines.

"I have to say that there were virtually no problems during this project," says Xue Rongjun. "It went very smoothly."

"The line started up in April 2014. The systems are running well and we are meeting all expectations in terms of capacity and quality. Of course, we look forward to tuning the system even more, with ANDRITZ's assistance, to improve final quality and increase fiber yield to the maximum."

The original design capacity for the machine was 1,918 t/d, but even early in the start-up curve the machine is already running over 2,000 t/d.

Zhou Zhiguo, PM8 Pulping Section Chief, came to the Longhai mill in 2012 as part of the project team for installing the stock preparation equipment. He moved to operations when the systems were started up and is now responsible for the pulp supply to PM8.

"I was familiar with ANDRITZ technology from other mills I had worked at," Zhou Zhiguo says. "We faced only small issues in starting up the line, and generally speaking, everything is running well. The quality of our pulp is top of the line. ANDRITZ had a good team for the project, the delivery went well, and overall we are happy with the technology and service."

"From our customers' perspective, the most important aspects of our coated white-top

board is the cleanliness and whiteness of the product," Xue Rongjun says. "On our side, that means that the deinking and stock preparation technology must deliver clean and bright furnish to our board machine. The DIP plant is easily achieving 65% ISO brightness and delivering very clean stock."

Meeting market demand

Market demand is increasing for higher value-added board products, rather than the straight commodities.

"That is what we are focused on, and we are taking actions to be a recognized supplier for these products," Xue Rongjun explains. "We have introduced the most advanced papermaking equipment and technology from Europe and utilize DCS control systems to

greatly improve our production efficiency. It is our plan to constantly improve our systems and facilities."

CONTACT
Jiang Weiqiang
weiqiang.jiang@andritz.com



◀ (l to r): Wu Xiayan, ANDRITZ; Xue Rongjun, Liansheng; and Jiang Weiqiang, ANDRITZ, inspect printing on white-top duplex board.

Mixed waste entering one of the FibreFlow Drum pulpers. ▼



Three of the four layers of the new white-coated board are processed by new ANDRITZ stock preparation systems. Shown here is one of two FibreFlow drum pulpers for processing recycled fiber. ▼



A BIG CAT IS RISING

—
in the Brazilian forest

The puma is the big cat of the Americas. Its strength, speed, and agility make it a respected neighbor in the forests. Klabin's own "puma" (the greenfield Puma Project in Brazil) is garnishing respect around the globe as it springs to life in an isolated location surrounded by plantation forests. At 1.5 million t/a, this is going to be one large cat!



▲ The Puma Project is being carved out of Klabin's extensive forest holdings in Paraná state in Brazil.



◀ Annual production capacity will be 1.5 million tonnes (1.1 million tonnes of hardwood and 400,000 tonnes of softwood). A sizable portion of the softwood will be produced as fluff pulp. Shown here is the ANDRITZ fiberline under construction.

Rogério Pacheco, Fiberline Site Manager, talks with a supervisor from the mechanical erection company. ▼



Pumas are solitary creatures, difficult to spot. Since they are most active in the twilight hours, and have excellent night vision, they are also very difficult to catch.

While there is no difficulty spotting the “Puma Project” from the air – Klabin’s greenfield mill is being carved out of forest plantations and inhabits 200 ha of real estate – the speed with which the project is progressing will make it very difficult for competitors to catch up.

Hardwood and fluff

The project got its name from some pumas which were spotted during pre-feasibility studies. Before choosing the Ortigueira (Paraná state) location, Klabin analyzed the region around the 345,000 ha of forest area (172,000 ha planted with pine and eucalyptus).

“We analyzed three possible sites in the area,” says João Braga, General Manager for the Puma Project. “This site was chosen due to being as close as possible to the forest while

avoiding concentration of transportation, noise, emissions, etc. with our Monte Alegre mill 30 km to the east.”

The mix of fiber gives Klabin a competitive edge, according to Francisco Razzolini, Project Director. “We use short and long fibers in ways that give us both technical and cost advantages,” says Razzolini. “Annual production capacity will be 1.5 million tonnes (1.1 million tonnes of hardwood and 400,000 tonnes of softwood). A sizable portion of the softwood will be produced as fluff pulp, which today is imported for the production of diapers and other hygiene products. Interestingly, we produced fluff pulp in the 1990’s. Resuming production will enable Brazilian customers to source fluff pulp locally.”

A shift in strategy

The Puma Project marks a change in Klabin’s business strategy, which has been focused on packaging papers and corrugated boxes. “It is a return to the market pulp business for

us,” says Razzolini. “We will move from a 1.8 million t/a paper and boxboard supplier, to a 3.5 million t/a company which also produces fiber and exports green energy.” The new plant investment has been reported to be BRL 5.8 billion (EUR 1.7 billion), the biggest investment in the company’s history.

In a recent development, it was announced that the Brazilian pulp producer Fibria will be the exclusive sales partner for a minimum of 900,000 tonnes per year of the Ortigueira mill’s hardwood pulp in countries outside South America. “The Puma Project marks our company’s return to the pulp trading market,” says Fabio Schvartsman, CEO of Klabin. “Combining our forestry and industrial competency with Fibria’s commercial experience will result in an operation that benefits both companies.”

Lots to do before construction

“There was nothing here when we arrived, just trees and hills,” says Braga. “Lots of hills. The

amount of earth moved to level out this site – 18.3 million cubic meters – makes this the largest earthmoving project that we know of in the industry.”

Taking into account periods of rainy weather, it took almost two years to complete the site preparation, which began March 2013. “One year before the final financing and Board approval, we established a small budget to start developing the site infrastructure and bring in

basic utilities,” Braga says. “This proved to be a wise decision that helped us speed up the installation of the plant after we received Board approval in 2014.”

Transportation is a major issue for any mill, this one being no exception. “The existing roads to the site are not good enough,” Braga says. “We are building two roads to improve access, a 22 km-long railway to connect this mill to the existing network, and another road with a

bridge over the river so our forestry operations can move logging trucks without having to put traffic on public highways.”

At its peak, the construction labor force will top 8,500 workers. The housing, feeding, and bussing of these workers have been a high priority for the Klabin team and its partners. The logistics are working smoothly.



“The amount of earth we moved to level out this site – 18.3 million cubic meters – makes this the largest earthmoving project that we know of in the industry.”

João Braga
Project General Manager, Klabin

Inside one of the lime kiln sections prior to assembly are (l to r): Cid Gagliotti, Civil Supervisor; Juliano Vieira, Site Manager; Alex Pitta, Automation and Instrumentation Engineer; Francisco Picussa, Mechanical Specialist; and André Hortelan, Tank Erection Supervisor, of ANDRITZ's white liquor plant team. ▶

There will be two kilns in the white liquor plant (650 t/d each). The building in the background will house equipment for green liquor filtration and white liquor preparation. ▼



◀ ANDRITZ'S Bruno Salamone, Project Engineer (left), and Olavo Filipecki, Project Manager, look over construction progress in the woodyard.

The ANDRITZ woodyard will have four debarking drums (structure for two of them shown in the foreground) four chippers, and two massive 360-degree stacker/reclaimers. ▼



▲ Francisco Razzolini, Klabin Project Director

The Puma team thought of everything – even devising a unique arrangement to share the “tax bonanza” that will come from the mill’s revenues. “We brokered an agreement among the 12 towns and cities in the area,” Razzolini says. “Half of the tax will go to jurisdiction where the mill is located (Ortigueira in this case), the remaining 50% will be split among the other 11 communities. We felt this was a way to lift up the entire area and they all agreed.”

Big cat – Green cat

The dimensions of this project are big: the area

that had to be cleared for the mill, the road and railway network, the number of people involved in construction, the size of the equipment, and the annual production. Yet even at this scale, there is consideration and respect for the environment.

“This site was chosen to put some distance between it and our Monte Alegre mill,” Braga says. “We felt this would be better for the environment and create a more positive social impact.”

About 75% of the workers are from Paraná state and 50% are from the three local municipalities. Since many of the new employees will not have specific pulping experience, Klabin contracted for ANDRITZ to supply its IDEAS dynamic simulator. The IDEAS system models the operation of the fiberlines, bleach plants, white liquor plant, evaporation plant, recovery boiler, and power boiler (even the equipment outside of ANDRITZ’s scope of supply) so that employees can be trained in a “virtual” environment even before the mill is operational. The simulator is also used for DCS checkout prior to commissioning to verify control loops and evaluate process performance. It will be used by Klabin after the start-up for training

new employees, cross-training existing employees, and simulating different scenarios in plant operation to optimize production.

“We are using the best available world-class technologies to maximize yield and minimize emissions and effluents,” Razzolini says. “The ANDRITZ DownFlow Lo-Solids cooking process gives good flexibility and their DD washers are well-proven in reducing chemical consumption. We conducted 40 cooking and bleaching trials at the ANDRITZ technical center in New York (USA).”

On the white liquor side, Klabin opted for two smaller ANDRITZ kilns rather than one large one. “Bringing in make-up lime to this mill would be difficult,” Razzolini says, “so we wanted to have redundancy in this area to increase our operational flexibility.”

There is even a protected watershed area inside the mill complex that has been preserved and construction crews are building around. “So, we are green even inside the mill gates,” Braga says.

Klabin has an abundance of trees in the form of FSC plantation forests. The Ortigueira mill

will process about six million tonnes of wood, so Klabin has dedicated about 107,000 ha of its forest plantations to ensure fiber supply for the mill. Razzolini points out that the average distance from forest to mill gate is only 72 km, which ensures a low total fiber cost.



“A lot of credit has to go to Klabin. The site preparation is in excellent shape.”

Paavo Tornaiainen
Commercial Project Director for ANDRITZ

An important player

“I have a good impression of ANDRITZ,” Braga says. “The quality of our pulp will be formed by ANDRITZ technologies in the woodyard and the fiberlines. This makes them an important player in this project. They have a very good project organization and they are working with three different civil construction companies and three different mechanical erection companies to reduce risk and maintain competitiveness. I think this is smart.”

“We are running to the original schedule,” says Paavo Tornaiainen, Commercial Project Director for ANDRITZ. “A lot of credit has to go to Klabin. They are very responsive as an owner and the site preparation is in excellent shape. This makes it possible for us to do our best work and is crucial to a good project.”

Rafael Sirtoli, ANDRITZ Project Director, cites the level of involvement from the owner’s side as being a very positive thing. “Members of the Klabin team sit in every weekly meeting and in the monthly status meetings and are fully involved,” he says. “It is very open and easy communications. Also, safety is very important and they monitor it carefully. They have a very professional team to work with.”

Energy exporter

One of the important by-products of the mill will be energy, since the mill will be more than self-sufficient in terms of electricity generation. Of the predicted 270 MW generated, 120 MW will be consumed by the mill. The rest will be available for its over-the-fence chemical suppliers and for sale as green energy to Brazil’s power grid.

Less than a year

“This is an amazing experience to be part of a project like this, which is the largest investment in my company’s 116-year history,” Braga says. “I have been involved in the planning since the very beginning and it is exciting watching our plans take solid form.”

It is less than one year from start-up in March 2016. “We will start production with hardwood and then 15 days later we will start-up the softwood line,” Razzolini says. “It is impossible to have everything under control all the time – but we have no major concerns.”

CONTACT
Rafael Sirtoli
rafael.sirtoli@andritz.com

“THEY MADE THINGS RIGHT”

As much as we want every installation to be a five-star success from start-up – not all of them are. ANDRITZ turned a bad situation around at Eldorado in Brazil. The mill is now achieving eye-popping production – with ANDRITZ as a partner.

“We are exceeding design and are on target to produce 1,620,000 tonnes this year.”

Fabio Nakano
General Mill Manager
Eldorado Celulose



The installation of two drying lines and four automated baling lines at the world's largest pulp mill – Eldorado Celulose in Três Lagoas – was destined to be another excellent reference. But, while the equipment is registering world-record performance today, there were some dark moments.

“Sometimes you learn more from adversity than you do from success,” says Karl Eickhoff philosophically. Eickhoff is Vice President of Pulp Drying for ANDRITZ. Even though he was not working in the Pulp Drying group when Eldorado was started up, he actively spearheaded the corrective actions to ensure problems were solved and will not come back “Our pulp drying plants are performing at world-class levels again,” Eickhoff says, “and we have our experience and the people at Eldorado to thank for that.”

“The issues were not design flaws, but mechanical problems and material selection in certain areas,” say Josué Fernandes and Ademilson Zeber, Production Coordinators in the drying plant. “But even in the worst of times, we made 85% of design production. Now, we are over 100%.”

“To be honest, I didn’t see how ANDRITZ was ever going to get us to world record production,” Fernandes, Coordinator for Packaging and Logistics, says. “But, they made things right.”

Improving each month

As Fabio Nakano, General Mill Manager, points out, the mill is exceeding design. “Our production last year was 1,568,000 bleached tonnes,” Nakano says. “Already in the first four months of this year, we have produced 512,000 tonnes, with time out for our annual shutdown. We are on target to produce 1,620,000 tonnes this year.”

March 2015 was a record month (146,964 t) and included a record day of 5,364 t. The drying plant is designed for 5,022 t/d. “We have the potential to do more,” Nakano asserts. “We have the best technologies and the best people here.”

Colliding forces

The “dark moments” were caused by a perfect storm of colliding issues: delays in civil construction which limited commissioning time, changes in the design of certain components, material selections that were not rugged enough, and just some bad luck.

It was during the Eldorado greenfield project that ANDRITZ launched a development program to take its drying technology to the next level. “We were having good success in the market,” says Thomas Kefer, Director of Pulp Drying Technology & Start-ups. “But, we were not satisfied to rest on our laurels.”

The development was aimed at achieving higher specific production and baling line speed, as well as reductions in energy and water consumption. “We also harmonized the designs of components we had acquired (sheet drying, cutter/layboy, baling line),” Kefer says.

It was decided to include some of these new design concepts in the Eldorado project, anticipating sufficient time for commissioning the new equipment. However, one of the civil contractors ANDRITZ hired went bankrupt, which had a “ripple effect” by delaying construction of the drying plant.

“The pressure to start up the mill according to the schedule promised to the owners exposed some mechanical failures in our lines,” explains Leonardo Figueiredo, ANDRITZ Brazil’s Sales Manager. “Clearly, Eldorado was not happy with unexpected downtime. Neither were we.”

Problems. Solved.

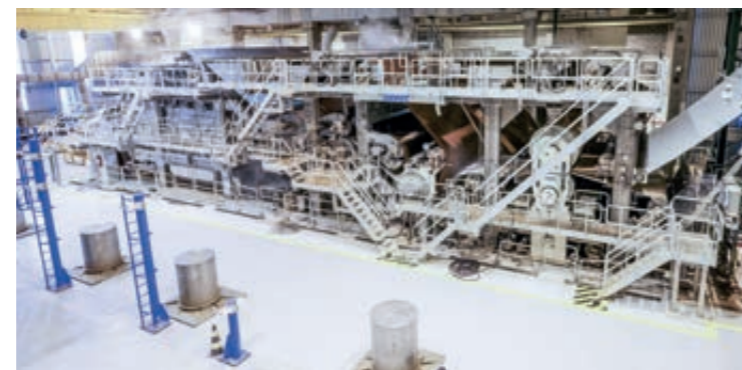
A task force of ANDRITZ experts set about evaluating, agreeing with Eldorado on priorities, and then correcting each problem. “ANDRITZ went down the machines, bolt by bolt, and changed out a weak link or re-designed a component,” Fernandes says. “After the changes were made, we could see big improvements.”

“The corrective actions were taken in an operating mill,” Figueiredo says. “We knew that the equipment could not be taken offline for extended periods, so our work had to be done during downtime or the annual shutdown.”



◀ Ademilson Zeber, Drying Coordinator, (left) with Josué Fernandes, Coordinator for Packaging and Logistics, at the press section of one of the two high-capacity dewatering machines.

Eldorado decided upon two drying lines and four automated baling lines to have more flexibility. One of the two 6.7 m wide dewatering machines is shown below. ▼



At the wet end, Eldorado was experiencing disturbances in formation and reliability issues in the press section. "Adding some blanks to the forming table eliminated bubbles," Zeber says. "With formation improved, we were immediately able to speed up the machine."

In the press section, there was a nagging problem with one bearing on the press roll. "It turned out to be the channels inside the bearing housing which did not allow the bearing to receive full lubrication," Kefer says. ANDRITZ re-designed the housing and bearing failure is no longer a concern, according to Zeber.

Changing a roll in the CombiPress from movable to stationary also solved certain issues. "After this," Fernandes recalls, "the wet end and dewatering machine were working fine."

At the outlet of the airborne dryer, there was a weak drive on the guide roll. This was replaced by a stronger one. At the cutter/layboy, ANDRITZ changed out the slitter knives and replaced the nip wheels with stronger ones. "We have not had a problem since," Fernandes says.

Along the wrapping and baling line, ANDRITZ reinforced some mechanical components. "We have now basically eliminated stoppages in this area," Fernandes says. "My baling line operators can almost sleep through their shift because the line runs beautifully at about 240 bales/h. The level of rejects from the cutter and baling line is practically zero. Just kidding about the sleeping, of course!"

Bottom line question, "Given the start-up problems and the early frustration here, would you ever choose to work with ANDRITZ on another project?"

"I would like to work with ANDRITZ again," Fernandes says. "Their design is good and now their performance is outstanding." Zeber agrees. "We run for about three months be-

tween sheet breaks on the first machine, and are fine-tuning the second machine to match this," he says. "I think this is pretty good, but we can always do better."

Nakano is also positive. "From my perspective, there is a great relationship between Eldorado and ANDRITZ," he says. "ANDRITZ was committed to isolating the problems and solving them. This is the mark of a good supplier-partner – a company that is around not only for the good times, but also when we experience problems."

CONTACT
Klaus Pöschl
klaus.poeschl@andritz.com

Leonardo Figueiredo
leonardo.figueiredo@andritz.com



◀ One of the airborne sheet dryers, cutter/layboy, and two of the automated baling lines at Eldorado.

NEXT-GENERATION PULPING?

Interview with Timo Merikallio, Project Director of the largest forest industry investment in Finland

“

All of our planning has been directed at not only producing high-quality pulp, but also to creating a platform for using all the production side streams to create value.



“One of the cornerstones in our design is that we are making the most environmentally sound processes in the world.”



New challenge

T. Merikallio: “I have been with the company since 1986, starting at Äänekoski, and have held a variety of positions. Recently, I was mill manager for both the Rauma and Joutseno mills (about 500 km apart), and then the Rauma mill alone before I was asked to lead a small team to do a pre-study for a new mill.”

Why Äänekoski?

T. Merikallio: “The location was fixed from the very beginning. Äänekoski is our oldest mill (established 1985) and this is an opportunity to update it. The site in south-central Finland is very good in terms of wood supply. There is a paperboard mill as our neighbor (Metsä Board) which can utilize some of our pulp. There are also talented people already on-site.”

The bio-product concept

T. Merikallio: “It may sound strange at first to call this a bio-product mill instead of a pulp mill. But hopefully I can explain.

All of our planning has been directed at not only producing high-quality pulp, but also to creating a platform for using all the production side streams. Wood fiber will be refined into several categories – bio-

materials, bio-energy, and bio-chemicals – which will result in great resource efficiency. We anticipate that 100% of the raw material will be converted to saleable, high value-added products or energy.

When the mill starts operation in 2017, there will be many options that can be explored to create value outside of pulp production. For example, we might have internal sulfuric acid production from the NCGs for tall oil cooking and chlorine dioxide production. We have thoughts for separating lignin in a unique way. And generating biogas from the sludge. Or producing textile fibers or bio-composites.”

A bio-product “ecosystem”

T. Merikallio: “We will not try to do these things alone. Our vision is to create a globally unique “ecosystem” with a variety of partners. We have the expertise and the insight right here in Finland to take this to an entirely new level. It will be quite exciting.

With the pulp mill at the center and as the cash-generator, we will form a network of partners to utilize the side streams. We hope that small- and medium-

sized enterprises will join us to produce innovative bio-products with high value added. The possibilities are almost endless: utilizing the bark, the turpentine, the tall oil, the other lignin products, the sludge, the ash, etc.”

Bio-energy

T. Merikallio: “This investment helps Finland toward its targets for the use of renewable energy. This mill will produce substantially more bio-energy than an ordinary pulp mill. And, none of it will come from fossil fuels. Our electricity self-sufficiency will be considerably high – about 240%. We will also produce 7,000 GWh per year of district heating and steam for the local community.

We will have a huge gasifier to produce our own fuel for the lime kiln as well as having biofuels available for sale. About half of our bark will be gasified for our own use. The rest will be sold as biofuel.”

Environmental impact

T. Merikallio: “One of the cornerstones in our design concept is that we are making the most environmentally sound processes in the world. As an example, we challenged ourselves that the addition of this new mill

at Äänekoski – which raises production 250% – will not raise the environmental permit levels over what they are today.”

Fiber supply and financing

T. Merikallio: “When operating, this mill will increase the use of fiber in Finland about 10% over today’s level. The increase will be primarily softwood, which we have a sustainable reserve of in this country. The wood will be sourced mainly from Finland from the Metsäliitto Cooperative (Finnish forest owners).

Our financing is solid. About 40% is internal to our Group with 60% financed. In addition, we received a EUR 32.1 million investment subsidy for renewable energy from the Finnish Ministry of Employment and the Economy.”

Risk mitigation

T. Merikallio: “One of the things we decided early on is that we don’t want to take any technological risks. We can, of course, take some scaling risk, as many of these systems will be the largest in the Northern Hemisphere. But all the technology has been proven somewhere in the world – and in a few cases there are larger systems out there.”

Good for Finland

T. Merikallio: “We estimate that the annual income effect on the Finnish economy will be about EUR 500 million per year. There is the obvious employment impact – 6,000 man-years during the construction phase and about 2,500 jobs after that. Plus, we placed orders for the technology with two primarily Finnish suppliers, including ANDRITZ. Over EUR 500 million of the main equipment and 100% of the detailed engineering will be provided domestically. ANDRITZ will deliver the woodyard, fiberline, evaporation plant, and recausticizing plant. So, ANDRITZ will play an important role in our success.

We have now issued the contracts for civil engineering and the main technologies and have begun our site work post-haste. The mill is scheduled to start up in 2017, so we do not have time to spare!”

ABOUT TIMO MERIKALLIO

Early years

Born 1955, the oldest of four children

Education

Graduated from Technical University of Helsinki with degree in Pulping & Wood Chemistry

Work life

- First job was as process engineer at New Zealand Forest Products
- Returned to Finland to work for Rauma Repola
- Joined Metsä Botnia in 1986: technical and management positions at Äänekoski, Joutseno, and Rauma, as well as 10 years in Corporate office as Senior Vice President for Customer Service and later Business Development

Private life

- Married with three adult children
- Hobbies include reading and golf (when there is time)

Passion

“I am passionate about the bio-product mill concept and working with young, intelligent engineers.”

Most important lesson

Never stop learning. It will keep you “Forever young!”

MARKET-ORIENTED SOLUTIONS

for modern deinking

One result of technology suppliers' continuous development of equipment for processing recovered paper is that the range of paper grades that can be successfully produced has grown considerably. Innovations in modern deinking plants enable these plants to produce excellent pulps even for high-grade printing and writing papers. Cleanliness and brightness requirements of the end product create significant challenges for suppliers of deinking technologies – as the goal is to produce deinked pulps with virtually the same characteristics of virgin pulp at lower cost.

Thanks to continuous improvements in processes and technologies, the spectrum of paper products being produced from waste paper has risen substantially. It was only about 30 years ago that recovered paper began being used as a partial substitution for mechanical pulp in newsprint production. Today, almost all paper grades can be manufactured using 100% recovered paper.

Recovered paper processing lines and deinking plants offer economic and environmental benefits. The economics are derived from the lower cost for recovered paper as a raw material. The environmental and climate compatibility benefits are numerous: reduction of waste going to landfill, reduction in greenhouse gas emissions, and reduction in effluents and discharges to the air.

The waste paper raw material utilized has a substantial influence on the quality of the final paper product. Chemical pulps deliver high-quality optical properties, strength, and cleanliness to the end product. Secondary fi-

ber pulps deliver certain advantages in terms of opacity, which is important for graphical papers. For sanitary papers, chemical pulp still provides the best quality parameters because this pulp has the necessary bulk and softness.

Recovered paper and contaminants

The configuration of a deinked pulp (DIP) plant is in large part determined by the contaminants which come into the plant with the secondary fiber. Various process stages are needed to remove undesirable and non-fiber components (such as stickies and printing ink particles) from the pulp, or to at least minimize their negative impacts without harming the fiber material.

The following main technological process stages are needed to improve the optical properties and treat contaminants in order to optimize the quality of DIP:

Pulping. Improving the optical cleanliness of pulp begins in the pulping process when the printing ink is detached. The high percent-

age of stickies in many office waste collections clearly favors the use of a drum pulper instead of a high-density pulper. For example, the proven ANDRITZ FibreFlow drum pulper uses gentle dropping and rolling forces to slush the pulp and defiberize it. This allows contaminants to be rejected virtually intact, taking stickies and trash from the pulp very early in the process.

Screening. The screening process removes most flat contaminants and stickies. Coarse screening is accomplished with pressure screens having screen baskets with very small hole diameters. The latest technology uses small-slotted baskets, such as the ANDRITZ Bar-Tec Rejector basket, which is an improvement over perforated designs, thanks to its specially shaped profile bar and slot geometry.

Flotation. The selective separation of the pulp suspension into two fractions – accept and reject – increases the brightness of the pulp. Dirt specks and ink particles are discharged from the flotation unit with the foam that is gen-



	3-loop system	Single-loop system
	Pulper feeding	Pulper feeding
	Pulping	Pulping
	HD cleaning	HD cleaning
		LC cleaning
	Coarse screening	
1 st loop	MC slot screening	Slot screening
	Flotation	Flotation
	LC cleaning	
	LC slot cleaning	
	Thickening	Thickening
	Dewatering	Dewatering
	Dispersing	Dispersing
		Bleaching
2 nd loop	Flotation	
	Thickening	
	Dewatering	
	Dispersing	
	Bleaching	
3 rd loop	Flotation	
	Thickening	
	Bleaching	

▲ Comparison of a 3-loop deinking plant concept with a single-loop system.

Tech Talk



◀ Overview of a modern 3-loop deinking plant.



erated by injectors (aerating elements which mix the pulp with air). In the new generation ANDRITZ SelectaFlot system, the improved design of the multi-injectors achieves highly effective aeration with the lowest energy consumption, also allowing it to operate at significantly lower pressure than before.

Dispersing. The dispersion process is responsible for detaching very small ink particles so that they can be removed, and also for fragmentation of any remaining specks to render them invisible – improving the optical properties of the final pulp.

Comparison of two system designs

By customizing the main process steps described above to match the raw materials and degree of contamination with the desired end paper product, a complete modern deinking system can be configured. For production of high-quality printing and writing grades, such as graphical papers and photocopy paper, 3-loop DIP processing is recommended in order to achieve the highest pulp quality.

A simpler single-loop deinking system, with its lower investment cost, will necessitate compromises in terms of pulp cleanliness. Take a 300 t/d (105,000 t/a) DIP plant for example; the investment costs calculated are approximately 40% lower for the simplified concept.

When comparing the two plant designs (3-loop vs. single-loop systems) the results that come from reducing the sub-systems and machinery in the simplified system becomes evident.

A clear difference is evident in the efficiencies achieved. Here, there are distinct advantages in the 3-loop system, particularly in brightness increase and removal of dirt specks.

Higher efficiencies introduce another variable in the mix: Lower quality (therefore cheaper) raw materials can be used in order to achieve similar pulp characteristics. For example, the raw material mix for a 3-loop deinking system might consist of 20% colored letters, 40% colored woodfree magazines, and 40% multiprint. The single-loop system would need approximately 50% white woodfree shavings for this purpose in addition to the multiprint raw material, which leads to considerably higher raw material costs.

A comparison of specific energy consumption of the two plant designs shows that the single-loop system uses about 60% less energy, since it does not include some of the energy-intensive process stages. Other costs, such as the cost of bleaching chemicals, also points to a clear

advantage for the simplified system because some individual process stages are omitted.

Even with these considerations, the DIP system with three loops is less expensive overall. Although the single-loop system has clear cost advantages in several areas, the higher cost of raw materials required for the simplified plant design overrides its other cost advantages. This becomes particularly noticeable over the life of the system, after the investment has been fully amortized.

In summary, it can be concluded that while using the lowest quality raw material for the desired end product incurs higher operating costs, and added investment cost, the overall life-cycle cost is lower when the savings in raw material costs are factored into the calculations.

CONTACT
Michael Rošker
michael.rosker@andritz.com

▼ Summary of costs

Parameter	3-loop system	Single-loop system	Relative costs of single-loop system
	EUR/t	EUR/t	
Investment	86	50	58%
Energy	21	9	43%
Chemicals	25	17	68%
Raw materials	191	320	168%
TOTAL	323	396	123%
Savings	73		
After depreciation:			
TOTAL	237	346	146%
Savings	109		

Mondi has invested significantly in Ružomberok, the site of Slovakia's largest integrated mill, in the past 10 years. This latest investment in new recovery systems from ANDRITZ not only removes a bottleneck, it also propels the mill toward energy self-sufficiency.

Yes, the technology to increase pulp production, produce more green energy, and improve the carbon footprint is working well. And yes, the project itself has been a resounding success in terms of schedule, budget, and safety according to Tomi Lonka, Mondi SCP Project Director and now the mill's Technical Director.

Great alignment

Lonka, originally from Finland, has carried out projects in places like China, Indonesia, and Brazil. He was familiar with ANDRITZ technol-

ogy, particularly in the kiln and recaust areas. "But this is my first project with an ANDRITZ recovery boiler," he is quick to point out.

"The level of cooperation has been excellent, Lonka says. "Both sides were well-aligned in terms of common targets and good communications. We openly discussed and resolved any issues. This was one of the key factors in this project's success."

"We were operating at full production the entire time," says Vladimír Krajčí, Pulp Operations Manager. "Our goal was to combine the several elements of the project in such a way as to minimize the impact on the mill."

De-bottlenecking and de-stressing

"In general, there is usually a bottleneck somewhere in a mill," explains Peter Scholtz,

Production Manager. "Here, the pressure has been on recovery. The equipment was always pushed to its limits – and so were my operators."

Parts of the mill's first recovery boiler (RB1 built in 1981) were approaching end of life. "Our options were to replace major components or invest in a new boiler that would give us better energy generation options," Krajčí says.

The kiln was installed probably 30 years ago and was "part Russian, part Western" according to Scholtz. "We were able to coax about 420 t/d out of it, but there were maintenance issues, dusting, and occasional plugging that were a constant challenge," he says.

"There were some corrosion issues with the old units, and the second effect was a prone-

ness to calcium scaling," says Peter Baláž, Mondi's Commissioning Manager for the project and now Recovery Line & Energy Manager. "We also wanted to increase the production of condensate to decrease fresh water consumption."

Good reference inside the mill

When Mondi approved the investment, several suppliers were evaluated. According to Baláž, "Important to us was a proven ability to meet our performance requirements and high safety standards. Characteristics such as quality, reliability, and the commercial terms were also important."

"It helped ANDRITZ that they had done such a good job with the RB2 (2005) project and that the boiler is operating so well," Scholtz says. "That gave them a good reference inside our mill. We visited an ANDRITZ reference in

Austria to see the kiln and recaust technology in operation."

Challenging schedule

The contract for the recovery boiler was signed in February 2013. The boiler started up in September 2014 – 18.5 months after contract signing. "By optimizing the construction part, we achieved maximum economic benefit," Lonka says. "We worked at a fast pace, with more or less 24/7 construction."

Says Oiva Väisänen, ANDRITZ Project Manager for the new recovery boiler, "On a fast-track schedule, there is no room for wasted effort or duplication. We worked as one team – Mondi and ANDRITZ. All the milestones were achieved at the times scheduled."

"There was especially good alignment during commissioning," Lonka says. "The project spanned two annual shutdowns. We were

able to accomplish all the mechanical work and tie-ins during these planned shuts. That was a very hectic time for all of us."

RB3: a new source of green energy

With the start-up of the new recovery boiler (RB3), the mill the mill significantly increased its energy self-sufficiency and reduced emissions.

During the sales phase, ANDRITZ presented different scenarios from a traditional boiler to a modern HERB (High Energy Recovery Boiler) design. "We aimed from the very beginning for a high-energy boiler," Krajčí says. "We knew

"We knew that a high-energy boiler would help us increase energy self-sufficiency while de-bottlenecking our recovery operations."

Vladimír Krajčí
Pulp Operations Manager

FAST AND GREEN.

Mill and its neighbors love the result.

People are all smiles – inside the mill gate and out – after the start-up of Mondi SCP's investment project in green energy at the Ružomberok mill in Slovakia.





▲ Peter Scholtz, Production Manager (left), with Peter Baláz, Mondi Commissioning Manager



▲ Oiva Väisänen, ANDRITZ Project Manager for the new recovery boiler (right), talks with Peter Kral, Mondi's recovery boiler Superintendent.

this would help us increase energy self-sufficiency while de-bottlenecking our recovery operations.”

RB3 has a capacity of 1,750 tds/d. Other design points are 87.7 kg/s steam at 495°C and 96 bar(a). “Our black liquor is on the low side in terms of chlorides, but higher in potassium,” Krajči explains. “This was a major factor in determining the design temperature and pressure of the boiler.”

The boiler was delivered on an EPC basis, with Mondi responsible for the civil construction. “We chose EPC because we could get exactly what we wanted, with the supplier’s guarantee that our return on investment would be delivered,” Lonka says.

According to Väisänen, “We were fortunate that there was a team of experts on the Mondi side who reviewed drawings and responded in a timely manner. Their professionalism helped us to stay on schedule.”

After start-up, the boiler was operated at 115% of capacity for testing. Normally it operates in the 90-95% range. “With RB3 on-stream, we do not need to push RB2 so hard anymore,” says Baláz.

Unique evaporator evolution

ANDRITZ converted Ružomberok’s two LTV evaporator trains into one plant with falling film (lamella) technology in a series of steps over the past few years. The last step, and part of

this project, was the addition of five vessels and a stripper system for the intermediate process condensate (B condensate). Nominal evaporation capacity increased from 470 to 550 t/h.

According to Tapio Lintunen, ANDRITZ Project Manager for the evaporation systems, “This evolution of the plant from LTV to falling film is quite unique in my experience.”

ANDRITZ had to do a lot of process design work to make the transition from the LTV units (built in the early 1970s) to falling film technology. “We had to check every pipe, pump, and valve in the process engineering phase to determine what could be kept and what would have to be replaced,” Lintunen says. “The surprise to me was the number of tie-ins.



▲ In a unique series of steps, ANDRITZ converted Ružomberok’s two LTV evaporator trains into one plant with falling film technology. Nominal evaporation capacity increased from 470 to 550 t/h.

Normally, we expect about 100, here there were about 240. Even with this, everything went well. Mondi handled the piping design in a short time frame and executed it well.”

This is the first time ANDRITZ has installed a light stripper in a Mondi mill. The light stripper purifies the B condensate. With this device, the COD load in the condensate is much lower.

The liquor leaves the evaporation plant at about 75% dry solids and is piped both to RB2 and to the HD concentrator 300 m away where it is boosted to 85% for RB3. “I learned that not many mills are running at 85% dry solids,” Krajči says. “We were able to do this virtually from start-up.”

“The lamella technology provides us with more heating surface and better throughput,” says Baláz. “We also have higher quality condensate which we can use in the bleach plant washers. We have been able to cut our consumption of fresh water because of this.”

Low-NOx LimeKiln

The new ANDRITZ LimeKiln, with its 4 m diameter, is designed for 510 t/d of production. It was delivered in 14 months from order to start-up, according to Hannu Sankala, ANDRITZ Project Manager for the kiln project.

“What we are seeing with the new kiln is better quality lime and more of it,” Scholtz says. “We have good control of dryness and carbonates. And, it operates with excellent stability.”

This LimeKiln has modern blow seal technology on the feed end and a low-NOx burner on the hot end. The blow seal contributes to a much cleaner environment outside the kiln. There are no significant dusting problems and the housekeeping is very clean.

“We have six low-NOx installed now,” Sankala says. “It uses a turbocharged pre-burner to mix the gas and air in such a way as to combust the remaining fuel gas completely. The result is lower emissions, even with the lower temperature in the burner tip.”

The burner system also incinerates odorous gases collected and processed by the new ANDRITZ methanol plant. There are three other locations (RB2, RB3, and a dedicated burner) where odorous gas can be burned.

According to Krajči, the new LimeKiln reduces the requirements for fresh lime and lime mud to be trucked to the mill. “We will reduce the number of trucks in and out of the mill by 2,000 per year,” he says.

Reduced stress

“Our old kiln operated until the August 2014 shutdown,” Lonka says. “We did the change-over in one week, and the new kiln began operation. The recovery boiler started up in September one day ahead of schedule. The turbine came on-line on time. All the plants are performing at the throughput and quality we contracted for.”

“Overall, the stress level of our recovery operators has reduced a lot,” Krajči smiles. “I now occasionally see feet up on the table now that their equipment is no longer the bottleneck. Now we need to enhance our fiberline – to put the pressure back on recovery.”

CONTACT

Recovery boiler:
Markku Teittinen
markku.teittinen@andritz.com

Evaporation plant:
Jan Ohman
jan.ohman@andritz.com

Lime kiln:
Harri Rautapää
harri.rautapaa@andritz.com



▲ Tomi Lonka, Mondi Project Director (left), with Vladimir Krajči, Pulp Operations Manager

“The level of cooperation has been excellent. All the plants are performing at the throughput and quality we contracted for.”

Tomi Lonka
Mondi Project Director



After a devastating blast

POWERFUL RECOVERY



It was three years ago that 98 containers of explosives being stored at a Naval base, self-detonated – triggering the worst peacetime military accident ever recorded on the island of Cyprus. The human toll was devastating – 13 people lost their lives and 65 others were injured. The nearby Vasilikos power station was destroyed. The recovery and rebuild of the plant since then has been nothing short of remarkable.

“We can’t save this.”

This was the first thought of Antonis Patsalis, Executive Manager of the Generation Business Unit for the Electricity Authority of Cyprus (EAC), when he saw what the explosion had done to Vasilikos. Despite the shock and disbelief, the reaction of Patsalis’ team was to get the still-burning fires put out. “Our overnight crew managed to put out a very dangerous fire in the fuel tank farm,” Patsalis says. “If that tank farm had gone up, that would have been the end of it.”

The next day, “It was scary – total silence.”

When Patsalis’ colleague Alexis Michael, Assistant Manager at the Vasilikos power station, first saw the damage, his reaction

was, “Where do you start to clean up this mess? What do we do to make this a power station again? Because it isn’t a station anymore.”

And yet today, the plant is back in normal production with the same capacity it had before the explosion. It has been a tough journey back, though.

A dark day

Exactly one second before 05:48 on the morning of July 11, 2011, the clock at Vasilikos stopped. At that moment, Patsalis and Michael were in their homes, getting ready for work.

The blast was so powerful (3.5 on the Richter scale) that Patsalis remembers his

wife saying, “It’s an earthquake!” Patsalis lives 29 km away from the naval base.

“My house is 40 km away, and I heard it too,” says Michael.

Houses and buildings within a 4 km radius from the base had their windows shattered by the blast. The resulting cloud of dust and smoke blocked out the sun. Unfortunately, the Vasilikos power station was not kilometers away from the base. It was right next door – only a couple of hundred meters from the explosion. The damage was monumental.

Most of the building roofs in the power plant collapsed. Cladding on the buildings was either blown away or damaged beyond

repair. There were multiple fires, and the boilers, generators, and other production equipment were severely damaged.

A difficult (re)birth

At first, the police wouldn’t allow power station employees into the plant; they had to wait until it was declared safe to enter. There were damaged fuel tanks on a site where fires were burning. There was a big danger of falling objects and even entire buildings (or what was left of them) collapsing. Also, the station had to be checked for radioactivity and explosive ordinance. Examination was done by robots and drones.

When the team was eventually allowed to enter, there were no longer any offices to work from. The initial assessment and planning work was carried out in the shade of a shed. And, ironically for a power station, there was no electricity.

As Michael points out, “At the peak of restoration, there were almost 1,000 people on site. And there were no flush toilets and no drinking water.” (Some Cypriot politicians who originally questioned the speed of

response to the accident visited the plant under these conditions – there was no more criticism after that!)

It was under these same conditions that plans had to be made to repair or replace virtually everything that was needed for the power station to return to service. And, it had to be done as rapidly as possible, because with Vasilikos not producing, Cyprus was suddenly and immediately short of power. Despite EAC putting its two other power stations, Dhekelia and Moni, into full production mode, Vasilikos was the largest of the three. As a result, the electricity shortfall was estimated to reach 430 MW during the summer of 2011.

Desperate times call for desperate measures

Even after a “remarkable” response from the people and businesses of Cyprus, who voluntarily reduced their energy use, EAC still had to implement rolling blackouts across the different sectors of society. The authority also was forced to take a number of expensive emergency measures to replace some of the missing power, includ-

“ANDRITZ was very professional. Things were falling apart and had been exposed to the weather for several months. But, still they got everything done.”

Antonis Patsalis
Executive Manager, Generation Business
Electricity Authority of Cyprus





ing importing electricity from the northern part of Cyprus, bringing in 85 MW of mobile generator capacity from Greece and Israel, performing a black start of the gas turbine at the heavily-damaged Vasilikos plant, and purchasing another 95 MW of temporary plant and installing it at Dhekelia and Moni Power Stations. The shortfall also required EAC to purchase an additional 120 MW of mobile generators to operate at Dhekelia and Moni the following summer.

All of the above – especially the mobile generators – were expensive, so the time-sensitive urgency of the situation was obvious to everyone.

First things first

Before work could begin on repairing and rebuilding the plant, it was necessary to accurately assess what the problems were and the severity.

Since the predecessor company to ANDRITZ Energy & Environment (AE&E) delivered the boilers to the original power plant, AE&E was an obvious candidate to

carry out a detailed inspection and assess the damage to Boilers #1 and #2.

“We had the detailed engineering drawings,” notes Nicholas Sideras, Head of Field Services and Spares for ANDRITZ. Sideras was also one of the people involved in building the original plant.

The damage inspection actually turned out to be one of the major challenges for ANDRITZ, according to Sideras. “This was a rare accident in an industrial context,” he says. “Normally, problems are expected to happen with the boiler internals, so we look inside-out. Boilers are not designed to withstand outside-in explosions. This made it difficult to find or estimate damage caused by the blast waves from the explosion.”

AE&E’s analysis indicated that repairs were possible in some cases, but in other cases the components would have to be replaced – especially the pressure parts. “There was big damage to the pressure parts,” says Sideras.

Still, this approach was far preferable to the alternative of completely replacing the plant, as far as EAC was concerned. “If we’d had to build it new, we would still be waiting,” says Patsalis.

Big job made even harder

A detailed understanding of what needed to be done was likely a factor in AE&E winning the contract to rebuild Boilers #1 and #2. But it was not the only factor or the only contract that was awarded to AE&E (details below).

Even with the tasks being itemized and estimated, the urgency to complete the rebuild had to be balanced against the need for much more caution than on a “normal” project. For example, the blast from the explosion had moved some walls/buckstays up to one meter. Several buildings had to be stabilized with struts and chains before people could be in or around them, simply to ensure they would not fall down.

This unusual and non-ideal situation, combined with the urgency, was one of the ma-

ior challenges for ANDRITZ, according to Sideras. The schedule was tight: despite the need to make the site infrastructure safe, and despite most supplies needing to be shipped to Cyprus from mainland Europe (taking 3-4 weeks each time), the installation work had to be completed in under six months. This required fast decision-making on-site to prevent delays and to give ANDRITZ engineering and manufacturing personnel the time they needed to complete their portion of the work.

And there was plenty of work to be done. ANDRITZ’s focus was on two of the station’s five boilers: replacing pressure parts (furnace walls, superheater bundles, headers, the boiler hopper, and manhole refractories), steel structure (main and secondary buckstays and the boiler house structure), ducting (flue gas and combustion air ducts with their supporting elements, expansion joints), piping and supports, the electrostatic precipitator (including insulation and cladding), the burners (burner valve stations, windboxes, expansion joints, burner

internals, burner throat refractories), and EC&I equipment (instruments, cables, cable trays, lighting, etc.).

Above and beyond

AE&E also was awarded other contracts at Vasilikos. EAC commissioned ANDRITZ to convert the boilers to fire on natural gas as well as the heavy fuel oil they had previously operated on. This conversion was already planned before the accident (natural gas is expected to be available on Cyprus in 2017). It was logical for EAC to commis-



“What do we do to make this a power station again? Because it isn’t a station anymore.”

Alexis Michael
Assistant Manager, Vasilikos Power Station
Electricity Authority of Cyprus.

sion the conversion at the same time, since major work was already being carried out on the boilers.

The rehabilitated and converted boilers were re-started in the summer of 2013. The work carried out by AE&E was without fail.

Besides the rehabilitation and conversion of the boilers, ANDRITZ was also asked to do additional work on both boilers: rehabilitate the electrostatic precipitator and burners; rehabilitate the EC&I; rehabilitate the turbine piping; and repair the sampling and dosing piping.

More than just technology

Several factors helped ANDRITZ win these multiple contracts. In addition to AE&E's proprietary knowledge of the two boilers, Patsalis highlights some non-technical reasons. "Some companies tried to exploit our emergency situation," he says. "They thought they could carry out work at any cost. This was not the case with ANDRITZ. ANDRITZ was humane."

Sideras mentions an event that illustrates this attitude. Unexpected damage was discovered when the plant was stripped down, and it was not initially clear whether this work was included in the contract or whether it would count as additional work. "The equipment needed replacing in any case, so we made a suggestion to the client that we discuss the commercial terms at a later date so we could start the work fast. It is very important to treat the other side fairly. That is the basis for you being treated fairly as well."

Michael of EAC agrees, "We executed this project under a very honest and open environment."

Quick reaction

This rehabilitation reflects what Sideras considers one of the key aspects of his company's capabilities: the ability to operate in new or unfamiliar situations and react quickly to unexpected developments.



▲ (Left to right): Nicholas Sideras, ANDRITZ; Antonis Patsalis, EAC; and Alexis Michael, EAC.

Another interesting example of the ANDRITZ attitude was the rehabilitation of the electrostatic precipitators (ESP) that are connected to Boilers #1 and #2. According to Patsalis, the ESPs had never been officially accepted from the original supplier before the accident, because the guaranteed emissions targets had not been met. After the accident, the supplier's loss adjusters declared that the ESPs were damaged beyond repair. After its analysis, AE&E presented a quotation to rebuild the units with the help of a partner, and even guaranteed to meet the original emissions targets. The rebuilt units are today up and running and meeting the emissions targets. "ANDRITZ took a risk," says Patsalis, who clearly appreciated the gesture.

A further demonstration of the relationship between AE&E and EAC came in the form of another challenge while the whole project was underway. Not a technological challenge, but a financial one. One of the consequences of the banking crisis that struck Cyprus in 2013 was that payments outside of Cyprus were temporarily banned. The rehabilitation of Vasilikos, as is common with such projects, involved

EAC agreeing to make payments at certain stages of the project, which it was blocked from doing. With an eye toward keeping the work progressing, AE&E and EAC managed to reach an agreement on when payments would be made, and the project continued as planned. Sideras comments, "We had developed a significant level of trust, so we found a way to solve the problem on the spot."

Knocked down, but not knocked out

As we said at the start of this article, the once devastated Vasilikos power station is operational today, with full capacity restored. ANDRITZ had a part to play in this remarkable comeback story. As Patsalis sums it up: "ANDRITZ was very professional. Things were falling apart and had been exposed to the weather for several months. But, still they got everything done."

CONTACT
Nicholas Sideras
nicholas.sideras@andritz.com

E.ON REVIVES BLACKBURN MEADOWS

—
by investing in a new
biomass power plant

The previous Blackburn Meadows Coal-Fired Power Station near Sheffield, England, was built between 1937 and 1942 and generated electricity until it was decommissioned and finally demolished in the 1980s. The site was dormant for more than a quarter of a century until E.ON completed its recent project to construct a new biomass fired power station. Having generated electricity for the first time last year, the plant marks a new era for the Blackburn Meadows site.





“It has been a very successful project. The equipment is robust and reliable. Layout is good, quality is good. We are happy with the results.”

Luke Ellis
Construction Project Manager
Blackburn Meadows Renewable Energy Plant

In November 2011, E.ON began preparing the Blackburn Meadows site for the construction of a renewable energy combined heat and power station. The plant, which is capable of producing 30 MW of electricity, using locally-sourced recycled waste wood, began generating electricity and synchronized with the local distribution network in June 2014. The plant has now been through a number of reliability and performance tests and is due to officially open in the coming months.

At full capacity, that level of electrical production is enough to power some 40,000 homes with renewable energy, and because this type of fuel is considered to be carbon neutral, it will help reduce emissions associated with energy generation. In layman's terms, electricity generated at Blackburn Meadows has the potential to displace around 80,000 tonnes of carbon dioxide every year, which is the equivalent of taking more than 20,000 cars off the UK's roads.

Blackburn Meadows Renewable Energy Plant joins E.ON's other renewable energy operations, including Steven's Croft Biomass Power Station near Lockerbie and 20 on-shore and offshore wind farms around the UK, with several others under development. The GBP 120 million biomass plant is a reflection of E.ON's commitment to investing in low carbon generation; for example, it has

invested over GBP 1.8 billion in renewables alone since 2009. Blackburn Meadows Renewable Energy Plant will also supply hot water to a new GBP 20 million low-carbon district heating network, which is due for completion early this year. The district heating network will also be designed to capture an additional 25MW of low grade heat energy which will be supplied as low carbon heat through a pipe network to a number of local businesses.

Up for the challenge

The Blackburn Meadows site was perfect for redevelopment of a new biomass power station due to its previous industrial heritage as a power generation site. There is an existing local substation, facilitating connection to the local electricity distribution network, as well as excellent close transport links for bringing in fuel and other plant consumables. However, despite this, E.ON has had to overcome several technical, physical and environmental hurdles before this new power station could become a reality.

For example, the Blackburn Meadows site is in a flood risk zone owing to the proximity of the River Don which flows right past the plant. E.ON conducted a flood risk assessment and developed an approach that could withstand serious flooding (“a one-in-a-100-year flood”). The measures included raising the whole footprint of the power station, as

well as leaving all the other land at Blackburn Meadows untouched to serve as a flood mitigation area.

The fact that the site is located on a relatively small area of land, very close to a busy city, presented E.ON's Blackburn Meadows Project Manager Luke Ellis and his team with another hurdle – how to organize the various contractors who would need to work on-site at the same time. “It was quite a challenge,” Ellis admits. “There was a lot of communication and coordination required on a daily basis but it was managed well by our project management team and our contractors, and the work was completed without any major glitches.”

Another key issue was environmental emissions. As Ellis explains, “Our environmental permit has strict emissions limits, which are set by the Environment Agency and must be adhered to at all times. This challenge was met with the help of emissions abatement technology, including a flue gas cleaning plant supplied by ANDRITZ Energy & Environment (AE&E). “The plant is entirely capable of complying with these limits during regular operation,” Ellis says.

AE&E also supplied the bubbling fluidized bed boiler and auxiliary equipment (see box). In fact, ANDRITZ was the single largest supplier for the project overall, supplying a large

portion of the boiler island, including the EcoFluid BFB (bubbling fluidized bed) boiler. The choice of technology for Blackburn Meadows – from internal fuel handling, to combustion, to flue gas cleaning – was driven by the plant's fuel supply.

Good with wood

There is a sustainable supply of waste wood materials located locally to Blackburn Meadows Renewable Energy Plant. Sources include end-of-life consumables (such as old furniture), construction and demolition wood, and commercial/industrial wood waste.

Ellis notes, “We knew that the waste wood fuel would not be consistent, with varying levels of moisture and differing chemical constituents dependent upon the type of wood. We chose ANDRITZ's fluidized bed technology because it is flexible in handling a variety of fuels, and because ANDRITZ had design features to accommodate the potential corrosion associated with using waste wood.”

Walther Hartl, ANDRITZ's Project Manager, says that, “The combustion process and the layout were key challenges for this project. The steam parameters with this fuel type re-

quire a certain layout. If there are any errors in the design, then the performance in terms of efficiency and reliability will be affected.

“The plant is currently running above its rated capacity, so we're clearly pleased with the performance.”

Project end

With the facility due to officially open in the coming months, Hartl sums up the project from his point of view: “We delivered on time, our technology is doing what it's supposed to, and the client is happy.”

Ellis has a similar summation. “We have a good working relationship with the Andritz team and it has been a very successful project. The equipment is robust and reliable. The layout and quality are good, and we are happy with the results.”

The final steps were for ANDRITZ to hand over the installation to E.ON which has now successfully taken place.

CONTACT
Walther Hartl
walther.hartl@andritz.com

ANDRITZ scope for the Blackburn Meadows project:

- EcoFluid BFB boiler and all auxiliary equipment
- Flue gas treatment plant
- Complete water and steam cycle
- Demineralized water plant
- Air-cooled condenser (including condensate system)
- Fuel oil handling, storage, and distribution system (only used as backup)
- Compressed air system
- Internal wood fuel handling system
- Auxiliary cooling water system (including cooling water for steam turbine)
- Electrical system
- Plant communication system (integrated system including redundant emissions monitoring)
- Heating, ventilating, and air conditioning systems for boiler and turbine building
- Boiler and turbine building including facade and roof



▲ Vibrating bed-ash dischargers of 1st pass before particle separation.



▲ Construction Project Manager Luke Ellis (left) with Walther Hartl, Project Manager from ANDRITZ.

UNLIKE ANY OTHER

A very special
sludge treatment plant

Aesthetically pleasing, technically advanced, and open to visitors. These are not terms normally associated with sewage sludge treatment plants! But this facility in Hong Kong is world-class unique. ANDRITZ delivered four boilers which produce heat and power from the sludge. And, did we mention the plant is the world's largest?

The Environmental Protection Department (EPD) of Hong Kong had a not-so-unique challenge: what to do with the mounting volume of sludge from wastewater treatment plants. The EPD's solution to this problem was extremely unique, however.

An island of sludge

Over 90% of Hong Kong's population is served by a public sewer system. The sewage is sent to plants for treatment. The

sludge from this treatment process has traditionally been disposed of at three landfills on the island. While it seems that all growing metropolitan areas have the challenge of disposing of municipal sludge, the fact that Hong Kong is an island makes land availability even more critical.

In just a few short years, the sludge volume that Hong Kong generates has nearly doubled to about 1,000 t/d. It is predicted

to rise steadily after this. Long-term landfilling of sludge will not be an environmentally sustainable option.

In order to deal with the ever-expanding need for sludge disposal and to relieve the burden on landfill capacity, a unique sludge treatment facility has been built in Tuen Mun on the northwest part of the island.

The Environmental Protection Department of Hong Kong provided funding for this unique sludge treatment facility in Tuen Mun on the northwest part of the island. The city of Shenzhen (mainland China) is in the background. ▼

Unique development

EPD awarded the USD 660 million Design-Build-Operate contract to Veolia Water and Veolia Environmental Services. Veolia will also operate the plant for a period of 15 years.

Emmanuel Toulan, Project Director for Veolia Water Solutions, joined the project in 2010. He has years of international project experience in many different industries. "I am supported here by a very large team," Toulan says. "I was involved very heavily in the design and procurement stages, while the construction is primarily overseen by our partners at Leighton and John Holland."

ANDRITZ Energy & Environment (AE&E) was awarded the contract to supply four EcoFluid bubbling bed fluidized steam boilers, which form the heart of the power plant. The power plant uses wastewater sludge as fuel. Not only does this generate low-cost electrical power, it also eliminates the cost and space required to landfill the sludge.

"What makes this plant unique in addition to its large size," Toulan says, "is the building design, degree of self-sufficiency, and educational purposes."

Design. The wave-like shape of the buildings harmonizes with the sea and mountains. The plant meshes beautifully with its location next to Shenzhen Bay.

Self-sufficiency. The plant is not connected to a potable water network or a public sewer system. Seawater is desalinated in an on-site plant. Rain water is also collected

"What makes this plant unique in addition to its large size is the building design, degree of self-sufficiency, and educational purposes."

Emmanuel Toulan
Project Director
Veolia Water Solutions

and used as process water. The plant has its own wastewater treatment system to eliminate discharges to the sea. Energy generated from the plant will exceed the needs of the plant and surplus energy will be supplied to the public power grid.

Educational purpose. In addition to the technological advances, the site is being constructed as an architectural and cultural landmark for Hong Kong. A unique aspect is the concept of including ecological education and leisure space for the public.



▲ Emmanuel Toulan, Project Director for Veolia Water Solutions (left), with Gottfried Mittendrein, ANDRITZ's General Site Manager for the project, on the public observation deck overlooking the plant and the boilers.



An auditorium, conference center, exhibition space, spa, coffee house, shops, and ecologically arranged gardens provide attractions for the public. A view of the bay, including the city of Shenzhen on mainland China across the bay, is available from an observation platform in the administration building – being built around the boiler stacks.

Power from sludge

“All of Hong Kong’s sewage treatment facilities together produce close to 1,000 t/d of sludge,” Toulan says. The Tuen Mun facility will have a capacity of 2,000 t/d when fully completed. It will also be capable of generating 14 MW of electricity.

According to Gottfried Mittendrein, ANDRITZ’s General Site Manager for the project, the power plant is based on AE&E’s EcoFluid boiler technology (bubbling fluidized bed) to incinerate the incoming sludge. AE&E has supplied four boilers which are arranged in two sets. Each has a 14 MW steam turbine.

Sludge partly comes to the facility by truck, but most comes by barge to reduce local pollution. The incoming sludge is dewatered and then fed to the EcoFluid boiler plant. The EcoFluid boiler incinerates the organic substances in the sludge, creating ash, flue gas, and heat. Each EcoFluid boiler can generate 27.5 MW from a maximum throughput of 23 t/h of sludge. The maximum steam output is 31.3 t/h for each boiler, at a temperature of 383° C and 42 bar pressure.

This means, at maximum capacity, each of the four boilers can accommodate 550 t/d of sludge. At this throughput, the EcoFluid boilers will lower greenhouse gas emissions and also reduce the volume of sludge going to landfill by 90%.

According to Mittendrein, “The EcoFluid boiler is very flexible in its ability to utilize alternative fuels. On average, the dewatered sludge entering the boiler is only about 31.4% dry solids. This is sufficient for sus-

taining incineration in the fluidized bed without having to add fossil fuels or thermally drying the sludge beforehand.”

The flue gas treatment system was designed to meet the strict environmental requirements and emissions standards in Hong Kong. The flue gas goes through a series of treatments before discharge, including a Selective Non-Catalytic Reduction System for NOx control, a dry reactor for acidic gases reduction, and a multi-cyclone and bag filter system for fine particulates removal. A monitoring station is being installed in the center of Tuen Mun to continuously analyze the air quality, ensuring that operation of the plant will not have an adverse effect on the environment.

Reaching performance

The boilers are being commissioned on a staggered schedule. There are two separate performance test periods. The first was a run of 72 hours at full capacity for three boilers and a turbine. This was recently completed with the equipment meeting its performance criteria.

As Mittendrein explains, “Both turbines have been commissioned and synchronized. The final test of the fourth boiler is expected to occur very soon.”

Mittendrein expects that the ANDRITZ power plant delivery will be completed in May 2015.

As Toulan explains, “This has been a difficult project. We have had to do a lot of training. Also, we have invested a lot of time working with local authorities to get the necessary permits and authorizations.”

Mittendrein says, “I have spent many years in Asia, but this is my first project in Hong Kong. This project confirms my experience that each country is different and that we cannot calculate project costs and schedules using European measures, for example. Everything – construction techniques, available skills, government oversight, and subcontractor quality – is different in each country. We have to do a professional job of managing those resources and delivering a quality power generation system to our customer.”

Toulan has positive things to say about the collaboration with ANDRITZ. “I am familiar with the ANDRITZ name because my company has purchased their equipment (decanter, filters, centrifuges) for wastewater projects in the past,” he says. “The ANDRITZ team on-site is a good one. They know what they are talking about. Their equipment is

proven and they have been very professional during the design, installation, and commissioning of their plant. They have consistently met their schedules and commitments.”

The Tuen Mun facility is currently operating with three boilers and a throughput of about 900 t/d of sludge. This throughput will be increased over the next few months to 1200 t/d. One thing that has been a bit different than expected to Mittendrein is the huge variations in sludge. “We have noticed that the heat value of the incoming sludge changes on a daily basis,” he says. “One day it will be 3.2 MJ/kg and the next day 4.5. This demonstrates the flexibility of the EcoFluid technology to handle these large swings.”

CONTACT
Gottfried Mittendrein
gottfried.mittendrein@andritz.com



▲ The power plant uses four EcoFluid boilers (bubbling fluidized bed technology), arranged in two sets, to incinerate the incoming sludge. Each has a 14 MW steam turbine.

The EcoFluid steam boiler systems at Tuen Mun

Technology	Bubbling fluidized bed (BFB) Ecofluid AC
Number of units	4
Fuel	Sewage sludge
Heating value range	3.0-5.8 MJ/kg
Max. fuel heating capacity	27.5 MW each unit
Max. sludge throughput	23 t/h each unit
Max. steam output	31.3 t/h each unit
Steam temperature	383 °C
Steam pressure	42 bar

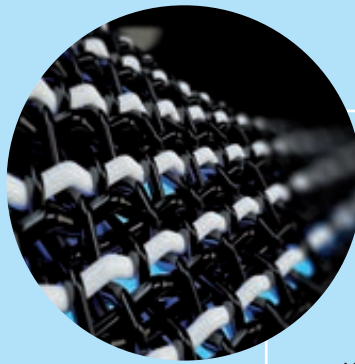


▲ The EcoFluid boilers are being commissioned and started up on a staggered schedule. The Tuen Mun facility is currently operating with two boilers and a throughput of about 660 t/d of sludge. Shown here is Johannes Geiger, ANDRITZ Commissioning Manager, checking the instrumentation at one of the boilers.



▲ Part of the AE&E commissioning team in the control room.

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