FiberSpectrum

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The Magazine of Andritz Pulp&Paper

"The Fray Bentos mill is an important investment for us. We knew there would be many challenges. That's why we want a proven partner, with the best available technology and maintenance practices, there with us."

Timo Piilonen, Senior Vice President of Metsä-Botnia

"Proven partners take on a new challenge together" Metsä-Botnia – Page 4

ANDRITZ

FiberSpectrum

The Magazine of Andritz Pulp & Paper

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Fripa

1st PrimeLineCOMPACT tissue machine comes on-stream at Fripa mill in Germany

There has been considerable interest about the Andritz PrimeLineCOMPACT line of tissue machines. The first unit started up at Fripa's Miltenberg mill in March. The COMPACT design covers a complete production line – from stock preparation to the parent roll, including automation. This machine at Miltenberg is designed to produce 30,000 t/a of soft tissue.

Dear Readers,

The articles in this issue of FiberSpectrum reflect the trends in our industry. The articles show Andritz's contribution to each of these trends and the partnerships we have established to successfully navigate the future as a leading technology and maintenance supplier to our valued customers.

Large single lines. *The start-up of Botnia's Fray Bentos mill is a great success for Botnia, and a showcase for the scope of supply that Andritz can offer pulp producers. All the major production technology comes from Andritz – as well as the long-term maintenance. It is also a showcase for a tremendously constructive cooperation between owner and supplier. You can read more about the project starting on page 4.*

Fast project start-ups. *Botnia is on a world-record pace in terms of start-ups. Prime quality pulp came off the line virtually from the moment chips were first fed to the digester. In the article about Kvarnsveden (starting on page 16), we see another example of a fast start-up, this time for mechanical pulps. Burgo's Mantova mill (starting on page 24) also realized the benefits of a fast start-up on its newsprint machine upgrade with a soft calendaring system.*

New concepts for maintenance. *A multi-year contract to perform complete maintenance in all areas of the Botnia mill highlights a different area of Andritz's commitment to enhance the life cycle performance of its equipment. In this case, the maintenance extends beyond the traditional areas for Andritz – including the Kemira chemical plant and virtually everything "inside the fence" at the mill. Next, we hope to integrate some of the new capabilities for automation/instrumentation maintenance acquired with Sindus Andritz of Brazil into our global maintenance capabilities.*

Energy and biomass. *The importance of energy-efficiency is highlighted in the article written by McKinsey and Co. (starting on page 20). The exciting development work that UPM is doing to convert biomass into second-generation biodiesel – and our partnership in developing the technology – is also highlighted in the article starting on page 12.*

Our global coverage and range is expanding. In emerging markets, such as Russia, we secured a large order from Mondi Syktyvkar Pulp and Paper Mill to supply a new woodyard, evaporation plant, and recovery boiler to the mill and to rebuild the mill's two existing fiberlines. This is the largest project underway in Russia at this time. In Brazil, we are currently shipping major production systems to Poyry Empreendimentos Industriais S.A., the contractor for VCP's mill in Brazil's Mato Grosso do Sul state, which will be the world's largest single fiberline.

In addition, we formed a new Automation Solutions Division within the Pulp and Paper Business Area. The new Division combines all the company's control capabilities under one roof and offers clear benefits to customers from design, through implementation, to on-going support.

We hope you enjoy this issue of FiberSpectrum. As always, we thank you for your continued trust in us.

Wolfgang Leitner

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Member of the Executive Board
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Member of the Executive Board
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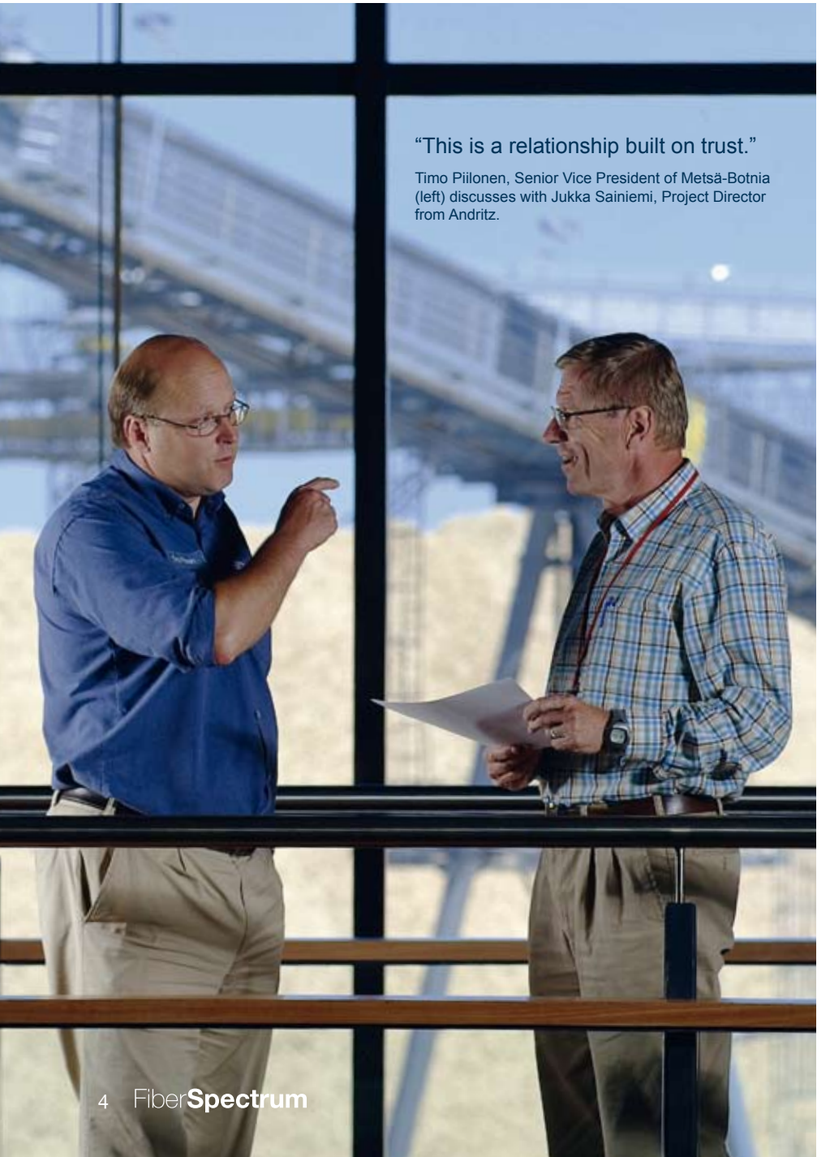
Proven partners take on a new challenge together.

The relationship between Metsä-Botnia and Andritz has strengthened over the years, with the most recent collaboration being Andritz's supply of all the major production systems for the greenfield pulp mill in Fray Bentos, Uruguay – plus maintenance for *all* areas of the mill. This scope has never been accomplished by a single supplier before.



"This is a relationship built on trust."

Timo Piilonen, Senior Vice President of Metsä-Botnia (left) discusses with Jukka Sainiemi, Project Director from Andritz.

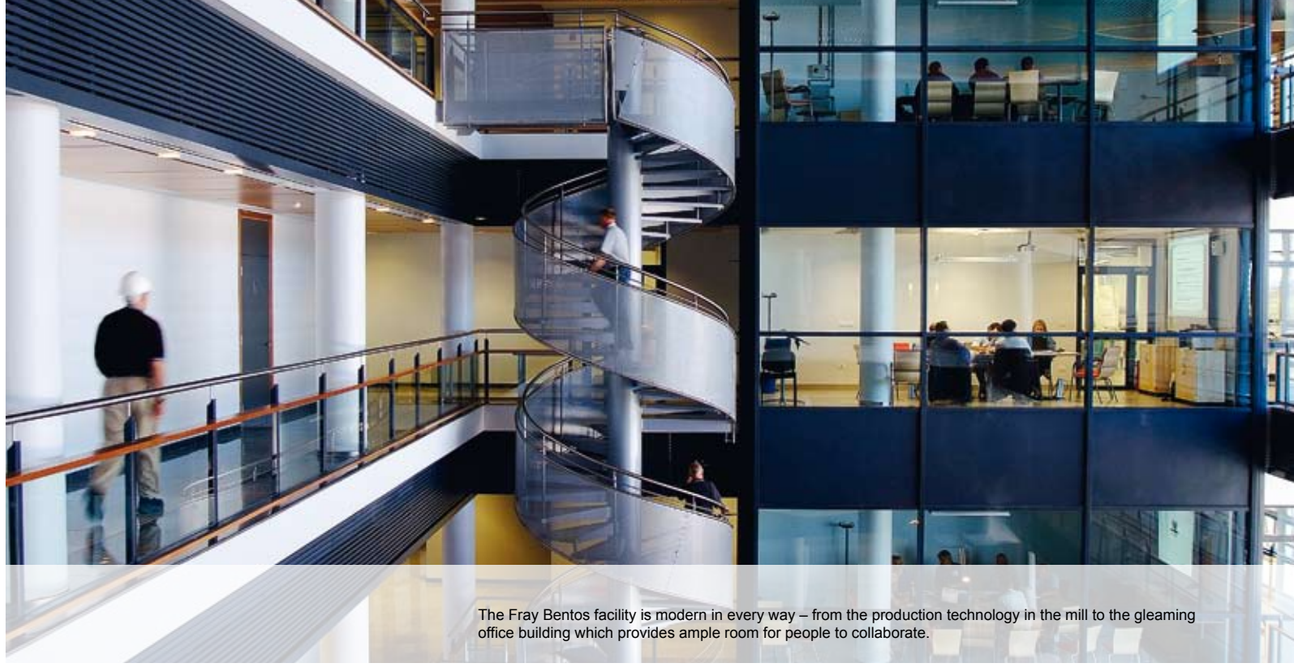
"The Finnish way of doing things is based upon trust," says Timo Piilonen, Senior Vice President of Metsä-Botnia and the leader of the Fray Bentos greenfield project. "From the beginning, we had a mixed organization of Andritz and Botnia – there was no buyer and no supplier."

Of course, this kind of relationship was not built overnight. Andritz supplied technology for Metsä-Botnia's first greenfield mill (Kaskinen) in the 1970's, and has supplied systems to all five mills in Finland. In addition, Andritz has provided maintenance development services to Botnia for many years.

So, it was logical for Botnia to partner with Andritz for its most grand collaboration to date – the very large greenfield kraft pulp mill in Uruguay. "Uruguay does not have a tradition of pulp and paper production, or even large process industries," Piilonen says. "We knew there would be challenges in getting resources and materials to the site. That is why we wanted proven partners there with us. With Andritz, we formed one organization with common targets and a very open way of working."

Looking for opportunities

A few years ago, Piilonen was chosen to lead a team to investigate Metsä-Botnia's production opportunities outside Finland. In 2003, Botnia purchased a 60% share of Compania Forestal Oriental S.A. (FOSA) from Shell, with the remaining shares owned by UPM. Also in 2003, Piilonen and his team performed a pre-feasibility study for citing a new pulp mill near Fray Bentos. In 2004, the first environmental impact study was presented to government officials.



The Fray Bentos facility is modern in every way – from the production technology in the mill to the gleaming office building which provides ample room for people to collaborate.

The project gained momentum when environmental permits were granted in March 2005. The Botnia board of directors approved the investment for the Fray Bentos mill. At a cost of about $1.2 billion, this became the company's largest investment outside Finland.

The Fray Bentos project

When a signed letter of intent was received from Botnia in May 2005, Andritz immediately set its project team in motion. Working with Project Director Jukka Sainiemi was a global team of project managers for each key process area, supported by technical experts, a global procurement team, site managers, and commissioning specialists.

"A fast start for the engineering was crucial for a successful project," Sainiemi says. "Botnia involved about 20 people from their team, supported by their engineering consultant and, of course, by Andritz. We were responsible for the basic engineering for each of our process islands. The engineering work was performed in Finland."

During the time that Andritz's project team was preparing quotations for the technology, its service team was putting together a 10-year maintenance plan and rough cost estimates, according to Risto Hämälainen, Senior Vice President, Pulp and Paper Mill Maintenance.

"In September 2005, Botnia signed an agreement with us to supply all mill maintenance services for a five-year period," Hämälainen says. "This gave the opportunity for Andritz Capital and Service specialists to work side-by-side to ensure that long-term maintenance aspects of the equipment were considered from the very beginning."

The project teams from Botnia and Andritz moved from Finland to Fray Bentos in the summer of 2006. Construction of the mill involved nearly 5000 construction workers who lived

▾ Two species of eucalyptus are mixed for Botnia's pulp. Botnia's subsidiary, Forestal Oriental, supplies about 70% of the mill's requirements from its FSC certified plantations.

"We cover the environmental aspects every day in our morning meeting as they have the highest priority."

Gervasio González, Environmental Manager at Fray Bentos mill

▾ The Andritz woodyard features a two-line chipping plant, chip storage, and chip screening system. Chip quality is maintained in two circular chip storage systems utilizing the latest blending technology for the FRB Euca pulp production from *eucalyptus grandis* and *eucalyptus dunnii*.

in Fray Bentos during the two-year build-up. Hans Unger, an Andritz site manager from Graz, likened the scene to a "miniature United Nations" with people from 25 countries working together to build this massive mill. Even with this, the majority of workers came from Uruguay – between 70-80% during the construction peak period were Uruguayans. Local companies from Uruguay participated in the general assembly work in all technical areas for which Andritz had responsibility.

Political opposition

The Fray Bentos mill is sited next to a river which forms the border between Uruguay and Argentina. The original announcement of plans to build a pulp mill in Uruguay (by the Spanish company ENCE in 2003) was met with strong opposition by Asamblea Ciudadana de Gualeguaychu, a citizen's movement in Argentina. Asamblea was concerned about how Uruguay would be able to monitor the environmental performance of such a large mill. Later, when Botnia also announced plans to build, the debate escalated to a national level. The government of Argentina took the offensive at the International Court of Justice in The Hague, claiming that Uruguay had violated a border treaty between the two countries.

"The Uruguayan people are now confident about what we are doing here," says Sergio Veintemilla, a Uruguayan and Service Manager for the chemical

▲▾ The 3200 admt/d bleached fiberline at Fray Bentos features a two-vessel Downflow Lo-Solids® digester with TurboFeed® chip feeding (shown to the right of the fiberline and in the photo below). Nine large Drum Displacer® (DD) washers perform brownstock washing, screening/post-oxygen washing, and bleaching. The bleach plant features the patented A-Stage™ for the first stage of the ECF bleaching process. The DD washers recycle bleaching filtrates to reduce the volume of effluent that must be processed in the water treatment facility.

recovery and energy areas of the mill. "There are perhaps some other people focused on the politics; we are focused on our work here. This mill has the latest technology in all the disciplines and is among the safest in the world."

First chips to the digester

The mill was thoroughly commissioned before its actual start-up. Operators were fully trained and ready, in part thanks to the Andritz group´s IDEAS Dynamic Process Simulator. When Botnia received the final permit to start-up the mill in November, the start-up crews were eager to spring into action. Thursday night (8 November), the oil burners in the massive Andritz recovery boiler were fired up and the digester was filled with liquor for the first time. Twenty-four hours later, chips began feeding to the digester. On Monday afternoon, the first sheets of dried prime quality pulp were coming from the Andritz baling line.

From that moment, according to Mill Manager Sami Saarela, progress has been rapid and stable. "We really worked to simplify the design of this mill, and it has paid off with a rapid start-up," Saarela says. "Early in the engineering phase, we worked with

“This mill has the most modern technology and the systems are easy to operate.”

Sami Saarela, Mill Manager at Fray Bentos.

▾ Andritz supplied the entire chemical recovery island. The evaporation capacity is 1100 t/h. The recovery boiler is among the world’s largest – burning up to 4450 tds/d.

Andritz to simplify our process. For example, we have simplified chip feeding, the four-stage bleach plant makes it easy to correct for any variations, and the two drying lines help us balance the mill’s whitewater and steam flows much easier.”

Saarela explains that the production goal is to produce as stable a quality as possible. “Unplanned production stops are the biggest enemy to pulp quality and the biggest potential for negative environmental impacts, so our target is to keep the mill running,” Saarela says. “We are seeing very stable and uniform production from the Andritz technology.”

Environmental monitoring

The Fray Bentos mill is based in all aspects on the best available technologies, e.g. for forestry, wood harvesting and transport, pulp production, pollution control, and environmental management. The Best Available Techniques (BAT) from Andritz are impressive in terms of scale and efficiency.

According to Gervasio González, Environmental Manager, the Fray Bentos mill has “some of the most strict permit levels in the world.”

“This mill functioned continuously without disturbances even during start-up,” González says. “We have the best technology available and we have trained the people the best we can. Anyone in the mill is empowered to stop the production process if they see an environmental situation. We cover the environmental aspects every day in our morning meeting as they have the highest priority.”

Compared to the amount of pulp produced, the emissions from the Fray Bentos mill are among the least intrusive in the world. Air emissions of TRS (odorous compounds) and sulfur dioxide have been virtually eliminated with the advanced chemical recovery technologies.

Modified cooking and efficient pulp washing lower the effluent load from the fiberline. Oxygen delignification and A-Stage bleaching decrease the amount of chemicals required.

As a result of using raw materials efficiently, there is very little solid residue left to discard to the landfill. In fact, less than 1% of the initial raw material is discarded.

Since the collection and treatment of odorous gases are a major factor in forming the local community’s opinion about having a pulp mill as a neighbor, designed into the plant are alternative ways to burn these gases. Electricity is also generated in an environmentally friendly way at the Fray Bentos mill. Botnia’s electricity generation adheres to the Clean Development Mechanism (CDM) which is determined in the Kyoto Protocol to the United Nations Framework Convention on Climate Change.

Long-term support

“A lot of work is involved in planning the maintenance of a new pulp mill, such as Fray Bentos,” says Lars Klang, Vice President of Mill Services and Logistics for Botnia. “The reason we chose to outsource our maintenance is that it is easier to focus people’s attention when it is a well-defined organization.”

“We can see the results already from choosing Andritz to perform our maintenance activities,” Klang says. “We are well prepared.”

Aulis Katajamäki is the Andritz manager on-site responsible for maintenance. In explaining Andritz’s interest in providing total maintenance services, Katajamäki says, “Customers used to call us when they had problems. Now we want them to call us before problems occur.”

“We are here to prevent problems,” Katajamäki continues. “Even though we act as part of the Botnia team, we are also Botnia’s portal into Andritz´s

The Andritz white liquor plant produces 10,000 m^3 of white liquor per day for the fiberline. The kiln – at 135 m long – can produce 830 t/d of lime. The primary fuel is heavy oil, although odorous gases collected from the pulping process are also utilized.

Andritz Technologies at Fray Bentos

Woodyard

Two-line chipping system, chip storage, chip screening, and conveying system to provide high-quality eucalyptus chips to the fiberline. Chipping capacity is 330 m³/hr.

Pulp Production

Two-vessel Downflow Lo-Solids® continuous digester (design capacity 3200 admt/d unbleached) with patented TurboFeed® chip feeding system produces high-yield, high-quality pulp. DD washers clean the pulp before and after two-stage oxygen delignification. Combined knot separation and screening system cleans the pulp prior to bleaching.

Pulp Bleaching

Four-stage light ECF bleaching with patented A-Stage™ to reduce the amount of bleaching chemicals required. No elemental chlorine is used in the bleaching process. Four efficient DD washers wash the pulp to final cleanliness and further reduce effluent volume due to filtrate recycling capabilities.

Dewatering / Drying / Baling

The drying plant consists of two parallel lines. Each line has a five-stage screening system to ensure pulp cleanliness, followed by a twin wire former pulp machine (5.3 m width) to dewater the pulp, followed by an Andritz dryer, followed by a Cutter/Layboy. There are four automated baling lines to weigh, press, wrap, stencil, and tie the dried pulp bales.

Chemical Recovery and Energy Production

The evaporation plant (1100 t/h) consists of seven effects of lamella-type evaporators, with internal stripping of volatile gases and the ability to segregate condensate streams. The recovery boiler is among the world's largest at 4450 tds/d. The white liquor plant (10,000 m³/d) consists of advanced technology for the filtration of green and white liquors, and a lime reburning kiln (830 t/d). A complete system for the collection of odorous gases and incineration in the recovery boiler (with backup alternatives in the auxiliary boilers) ensures low odor emissions from the mill. The steam from the recovery boiler is sufficient for the turbo generator to generate enough electricity to power the entire mill.

Dynamic simulation

Dynamic Process Simulator from IDEAS to model all the mill's processes for training operators prior to start-up.

▲ No other pulp company has a product range that includes euca pulp as well as strong reinforcement pulp. The main markets for Botnia's FRB Euca pulp are China and Europe. Approximately 70% will be sold to Botnia's owners (UPM-Kymmene and M-Real) and approximately 30% as market pulp. As part of the drying plant delivery, Andritz supplied two Andritz dryers, two Cutter/Layboys and four automated baling lines.

For added flexibility, Botnia selected two identical Andritz 1800 admt/d dewatering and drying lines. Dewatering is performed using Andritz's Twin Wire Former pulp machines, with trim widths of 5.3 meters.

technical support. We also give feedback about equipment performance to the product designers, based on our day-to-day experience. We are not just a corrective service organization."

Pasi Sahlman, a member of the maintenance team's Reliability Group, explains the depth of pre-engineering and planning for Fray Bentos that occurred even before the mill started up. "We have over 400 categories of equipment defined in our preventive maintenance (PM) system," Sahlman says. "We determined how important each piece of equipment was to the process, the time required to repair, cost to repair, etc. From this, we developed a preventive and predictive maintenance plan and entered it into Botnia's SAP PM computer system."

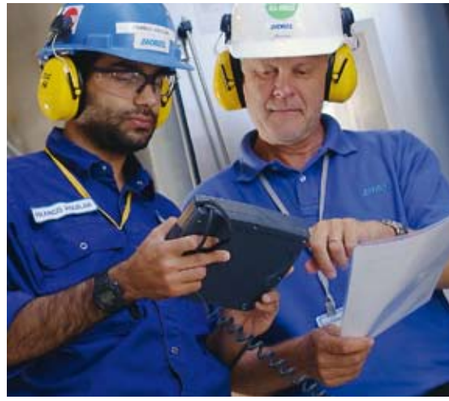
The maintenance target for Fray Bentos is to have better productivity (in terms of maintenance cost per tonne of pulp produced) than it has today in Finland.

Today, 95% of the maintenance staff is from Uruguay, and Andritz's goal is to make it 100% Uruguayan. Since Uruguay does not have a tradition of pulp production as Nordic countries do, this required Andritz to recruit locally and train extensively. "The key people for our maintenance group were hired here in Uruguay two years ago and trained extensively in Finland," Katajamäki says. Local companies have been hired as subcontractors for auxiliary maintenance services (HVAC, cleaning, etc.).

By adding the ability to produce pulp and paper to the established ability to export solid wood materials, Andritz's technology and maintenance expertise enables Botnia to help Uruguay develop a new industry and provide significant positive socioeconomic impact in the entire region.

►► find out more at www.fiberspectrum.andritz.com

▲ "The Uruguayan people are now confident about what we are doing here," says Sergio Veintemilla, a Uruguayan and Service Manager for the chemical recovery and energy areas of the mill (right). Here he discusses preventive maintenance plans with Frederico Mazzilli, of Andritz's maintenance group.



▲ Franco Aguilar, an Analyzing Specialist for Instrumentation (left) and Ari Markkanen, Superintendent of Automation Maintenance for Andritz Uruguay.

"A project this size requires extensive maintenance planning. We are well prepared."

Aulis Katajamäki, Project Manager for Maintenance from Andritz (left) and Lars Klang, Vice President of Mill Services for Botnia.

From biomass to **biobusiness**

Many experts say that first-generation biofuels are doing our planet more harm than good. So, UPM of Finland is investing in second-generation technologies to turn biomass into liquid fuels. The creation of synthetic diesel and other biochemicals from forest residues represents a ground floor (or actually forest floor) opportunity. UPM's chosen partners in key technology development? Andritz and Carbona.

Editor's note: Since the biofuel business may be new to many readers, we have included a glossary of terms, "Talking the Biolingo" on page 15 which you may find helpful.

"In addition to biofuels, we have identified what we call native wood chemicals – those chemicals found in trees that can be extracted or utilized without much processing. We see potential for biochemicals that are in demand by the pharmaceutical companies, for dietary/food products, and for cosmetics."

Petri Kukkonen, Director of Business Development of UPM-Kymmene Corporation.

"Developed nations are looking for alternatives to fossil fuels," says Petri Kukkonen, Director of Business Development for UPM-Kymmene Corporation. "Second-generation biofuels have the potential to be a big part of the solution. And, UPM has the potential to provide these biofuels while developing a profitable business in a fast-moving market."

The pace of development is exciting. UPM is leading a fast-track program to investigate the production of biofuels on a commercial scale, along with Carbona/Andritz and GTI. More about these partners in a minute.

It starts on the forest floor

According to Kukkonen, there are significant differences between first- and second-generation biofuels. Until now, the EU has mainly focused on first-generation. However, concerns are being raised that first-generation biofuels actually produce more greenhouse gases than conventional fuels if you include the emissions from agriculture, transport, and processing. In addition, diverting foodstuffs to biofuel production is triggering a record rise in the price of edible oils and other foods. Lastly, imports of ethanol vegetable oils or biodiesel from countries where rainforests are being cleared is causing some groups to label first-generation biofuels "deforestation diesel."

According to Kukkonen, second-generation biofuels do not compete with food crops, significantly reduce CO_2 production, and can offer better performance in vehicle engines. Used at 100% concentration, second-generation biofuels could reduce well-to-wheels CO_2 production by up to 95%.

"Second-generation biofuels will be based largely on wood residues," Kukkonen explains. "UPM knows how to cultivate, harvest, and process wood. We have the infrastructure in place to deliver the highest possible energy yield for society."

Log wood, pulp wood, energy wood

Typically, a tree is divided into three sections, Kukkonen explains. "One section is the log wood for the sawmill, one section is pulp wood, and the third section is energy wood." UPM's energy wood harvest equals about 3.5 TWh per year. It includes small diameters, branches, and stumps.

Stumps? "Stumps will be an important portion of the biomass feedstock," Kukkonen says. "UPM is the only company that collects and processes spruce stumps on a large scale. There is as much energy in the stumps as in the other forest residue combined. About 13-15% of the volume of roundwood entering the mill consists of bark."

The Carbona connection

The main path for second-generation bioenergy production is through gasification. This is where Carbona comes in.

Carbona was formed in 1996, when partners Kari Salo and Jim Patel bought the technology from a Finnish company and ventured out on their own.

Both Salo and Patel have spent virtually their entire adult lives around gasification technology. Their paths converged in the late 1980's when

Andritz and **biomass**

Andritz has become increasingly active in the promising liquid biofuel industry as the battle against climate change and high oil prices are initiating global developments.

The product portfolio includes systems for the front-end wood processing equipment, drying systems for biomass, pelletizing machinery, centrifuges for bioethanol production, gasifiers, and biomass power boilers.

Specifically, Andritz now offers Bubbling Fluidized Bed boilers for different biomass fuels to the pulp, paper, and power industries. Currently, four such boilers have been sold or are in the order process. Two units are destined for Spain (subsidiaries of the ENCE Group), one rated at 120 t/h of steam and the other at 195 t/h. Two units have been sold to Portucel in Portugal (58 t/h each).

▼ GTI's Flex-Fuel Test Facility in the USA is a state-of-the-art site for evaluating gasification processes. Pilot testing of the Carbona/Andritz technologies is currently underway here.

the Gas Technology Institute (where Patel was working) sold the license for its U-GAS® process to the company where Salo was Director of Technology. Working cooperatively, they built a coal gasification pilot plant in Tampere, Finland. The system was then converted for biomass gasification.

"We went to different vendors looking for gasification solutions," Kukkonen of UPM says. "We knew that we wanted fluidized bed technology, and were interested in Carbona's solutions. Carbona has the knowledge and Andritz has the muscle."

Patel explains, "Despite our experience, Carbona was too small to be a strong financial partner for the large pulp and paper companies." In August 2006, Andritz acquired a minority share position in Carbona, with an option for full ownership in the future.

In May 2007, UPM announced its cooperation with Carbona/Andritz on the development of technology for biomass gasification and synthetic gas purification. The cooperation also covers the design and supply of a commercial-scale biomass gasification plant.

"The goal of our project is to develop a technology platform that we can duplicate for multiple sites," Kukkonen says. "First, we have to prove the gasifier concept and run it in a reliable manner. Of course there are challenges, but we have some experience feeding wood into pressurized vessels."

UPM has prepared the biomass feedstock in pellet form and is in the process of shipping 1000 tonnes to the Flex-Fuel Test Facility near Chicago, Illinois USA.

Shaving two years off the schedule?

Carbona's close relationship with the Gas Technology Institute (GTI) has helped UPM keep on its fast-track schedule. "If we didn't have access to GTI's plant, we would have to build a pilot plant from scratch, which would take 18 to 30 months, and then begin a 6-month testing program," Kukkonen says.

According to Bruce Bryan, Director of Gasification at GTI, the test facility is unique in its capabilities for evaluating different systems and processes. "The facility is configurable to test a variety of gasification, gas clean-up, and processing schemes," Bryan says. "The instrumentation and control systems in the facility are unparalleled, offering online analyses of gas compositions for instant feedback about the performance of gasification and gas conditioning systems. We don't have to wait for lab tests as we can see what's happening online."

Modifications to the GTI test facility, which center around Carbona's technology for gas reforming/cleaning, are being completed. Salo explains, "A common problem with the F-T process is the sensitivity of the catalyst to contamination. Most likely, the catalyst will be cobalt. This requires a very pure syngas, so gas cleaning becomes extremely critical."

▼ Bruce Bryan (left), Director of Gasification at GTI, and Jim Patel of Carbona show the pelletized biomass feedstock shipped from UPM to the GTI test facility. The blue vessel behind Patel is part of the biomass gasifier at GTI.

▲ The test facility at the Gas Technology Institute is configurable to test a variety of gasification and gas clean-up schemes.

◄ Modern instrumentation and control systems give testers instant feedback about gas analyses without having to wait for standard lab tests.

"The pilot tests will verify the technologies for the feed system, gas cleaning, scrubbing, the syngas recycling compressor system, and the cooler," Kukkonen says. "We expect to have results by the end of the year. Based on these results, we'll move forward with the next step."

The next step: commercial-scale

"First-generation biofuel suppliers can be more entrepreneurial," Kukkonen says. "But, second-generation companies have to be well funded because of the capital investments required for the multi-stage process."

"Pulp and paper companies have a distinct advantage," Kukkonen says. "Biofuel production totally fits our infrastructure. We have access to biomass and much of the equipment, utilities, transportation, water treatment, and effluent treatment in place."

The commercial-scale plant that UPM has in mind will produce about 100,000 to 150,000 t/a of finished product – a synthetic diesel fuel much cleaner than conventional diesel. The feedstock required for this will be about 1,000,000 t/a of biomass, so the ratio is about 10:1.

"With Andritz and Carbona, we have completed the conceptual engineering for the plant," Kukkonen says. "Andritz has the technology, starting from wood handling equipment and dryers. We hope they will provide technical solutions for our integrated processes from wood processing to the balance of plant."

UPM has yet to select the site for its plant. "We have many good sites, 17 in Europe in fact," Kukkonen says. "Our decision criteria will be based on the mill having space available and the cost of the biomass feedstock."

►► find out more at www.fiberspectrum.andritz.com

Talking the Biolingo

Biomass. A wide-ranging term meaning any source of organic carbon (plant materials) that is renewed rapidly as part of the carbon cycle.

Biomass-To-Liquid (BTL). Synthetic fuels made from biomass that are similar to current fossil-derived fuels so they can be used in existing fuel distribution systems and with standard engines.

First-generation biofuels. Biofuels made from foodstuffs with either a high starch content (e.g. sugar beets, sugar cane, potatoes) or oil content (rapeseed, soybean oil).

Ethanol. Ethanol is produced by fermenting plant sugars in a watery solution which is then separated by distillation. A typical 10% blend of corn ethanol in U.S. gasoline can reduce well-to-wheels CO_2 emissions by approximately 3%.

Fischer-Tropsch (F-T). Catalyzed chemical reaction in which carbon monoxide and hydrogen are converted into liquid hydrocarbons of various forms. The F-T process is an established technology that is applied on a large scale for coal and natural gas.

Gasification. A process that converts carbon-containing materials into carbon monoxide and hydrogen by reacting the materials at high temperatures (> 700°C) with a controlled amount of oxygen. The resulting gas mixture is called syngas. The gasification of biomass is carbon neutral.

Second-generation biofuels. Biofuels from ligno-cellulosic sources (e.g. forest residues). Second-generation materials will be converted into liquid biofuels via BTL technology.

Syngas. Synthesis gas created during the gasification process. The syngas is cleaned and the ratio of hydrogen and carbon monoxide is adjusted before being converted into synthetic fuel in the F-T process.

Well-to-wheels. Biofuels have the potential to cut greenhouse gas emissions because the plants they are made from absorb CO_2 as they grow. An assessment of the life cycle impact is called a well-to-wheels study – calculating the net CO_2 from the growing of the plant right through to the vehicle exhaust emissions.

Where there's a will, **there's a way**

Coordination, cooperation, communication – the successful elements for any capital project – require a commitment from both supplier and customer. A textbook example of this commitment is the new bleach plant at Stora Enso's Kvarnsveden Mill. The plant had to be brought online quickly for a new SC grade being produced at the mill.

"Over 80% of our final products and about 45% of our wood are conveyed by rail, making the transport as environmentally friendly as possible."

Kjell Nygren, Manager of Projects & Strategic Planning, Stora Enso Kvarnsveden

Stora Enso's Kvarnsveden Mill is a modern facility mill in Borlänge, originally built in 1900 on the banks of the Dalälven River in the heart of Sweden. Many generations of Borlänge people have earned their living working at the mill, which employs more than 900 people.

The mill's product range focuses on three paper grades: newsprint, improved newsprint, and uncoated magazine paper. The current production capacity of the mill is 970,000 tons per year on four paper machines.

Mechanical pulp (groundwood and TMP) is produced in the mill. Most of the raw materials is spruce. "Over 80% of our final products and about 45% of our wood are conveyed by rail, making the transport as environmentally friendly as possible," says Kjell Nygren, Manager of Projects & Strategic Planning for Kvarnsveden, and a key player in the recent bleach plant installation with Andritz.

KP-M Project

"We have a series of improvement actions under the name KP-M project, based upon a strategic decision taken in 2003," explains Stefan Pettersson, Assistant Superintendent of Woodhandling and Groundwood. KP-M stands for Kvarnsveden Paper mill, Magazine. The M can also stand for Million, as the total production will be more than one million tons per year.

"Our objective has been to continuously improve the quality of SC paper, especially our top brands," says Per Stenberg, Project Manager.

▸ Per Stenberg, Project Manager (left) and Stefan Pettersson, Assistant Superintendent of Woodhandling and Groundwood discuss Kvarnsveden's KP-M project. Stora Enso's decision to close down a mill in Germany and shift production of its high-quality InnoPress brand to Kvarnsveden prompted the need for a new bleach plant – and drove the fast-track schedule.

A shift in production

Stora Enso's decision to close down its Reisholz Mill in Germany by the end of 2007 and move production of its high-quality InnoPress brand to PM 8 at Kvarnsveden prompted the need for a new bleach plant – and drove the fast-track schedule.

InnoPress is one of Stora Enso's top brands, says Stenberg. "Both InnoPress and MagniPress represent some of our highest standards."

InnoPress is also well in demand by major European customers. So, Stora Enso needed a smooth transition in production from Reisholz to Kvarnsveden. After a quick decision by the Board in November 2006, a contract was signed with Andritz on December 7 for delivery of the PHC bleach plant. In November 2007, operations were up and running, according to Stenberg.

"We chose Andritz because we knew that they could deliver the equipment in time and they have an excellent reputation," Stenberg says. "References were extremely important. Andritz has a long history of success with Stora Enso, having delivered bleach plants for example to the Summa Mill in Finland, the Maxau and Reisholz Mills in Germany …so yes, there is a long and solid cooperation."

Expanded Andritz scope

The equipment Andritz supplied for the Kvarnsveden Mill consisted of two twin-wire presses, an HC-mixer, and HC-tower – as well as a screw conveyor system and four MC-pumps. Andritz was also responsible for engineering as well as for DCS (Distributed Control System) programming, complete mechanical installation, training, commissioning, and start-up.

▾ Andritz's delivery included these two twin-wire presses installed where PM 9 once stood. The components for the bleaching line were lowered into the building through the roof, using two large cranes.

Though it was rather uncommon for Kvarnsveden, the mill contracted with Andritz to perform the detailed engineering for the bleach plant project. "We usually do this on our own with local support," Stenberg says, "but in this case it made our life much easier in the planning phase and helped us meet the tight schedule."

The first phase of the project was to decide upon the precise bleaching concept. This was followed by detailed engineering diagrams, flowsheets, and equipment layouts. "What is very important in this kind of operation is quality process engineering," Stenberg notes.

Cooperation, coordination, communication

Technically speaking, the Kvarnsveden Mill's bleach plant is similar to the other 130 that Andritz has installed. "But what made this project challenging for all of us – and exciting when you see the outcome – was the tight schedule of the delivery and installation," says Josef Liendl, Sales Manager for Mechanical Pulping Systems at Andritz.

Due to worldwide shortages, some components such as gearboxes and the stainless steel for the twin-wire press nips were extremely hard to procure. "Our sub-suppliers' order books are quite full with orders from Chinese customers for the next few years," Liendl says. "It took quite a lot of effort and some additional money, but we were able to get the materials for Kvarnsveden in time."

▲ One of the twin-wire press units is shown in the photo above. In the photo below, Stefan Pettersson (left), Josef Liendl (center), Andritz Sales Manager for Mechanical Pulping Systems and Per Stenberg are standing in the basement of the bleach plant. Andritz also provided basic and detailed engineering, control system programming, mechanical installation, training, commissioning, and start-up services.

For all those involved in the project, one of the key success factors was the easy flow of communications. There was very good cooperation within and between the project teams which contributed to the precise planning, delivery, and execution of the project.

"All our discussions were very open," Stenberg says. "Together we came up with a very straight equipment layout, instead of the original idea of a side-by-side arrangement." The twin-wire presses are now located where Kvarnsveden's PM 9 once stood which allows perfect access for the overhead crane. "With this solution, we could even install a third twin-wire press in the future in line with the existing ones," Liendl agrees.

An interesting aspect of the new Andritz line is that it was placed in the center of the existing building through the roof opening. This required the use of the largest and most out-reaching mobile cranes available in the region. According to Günther Glück, Andritz Project Manager, "The lifting boom was 42.5 m long. It was quite challenging to move the components for the bleach tower bottom and discharge system with two cranes (one 250-ton and one 200-ton) working in coordination...especially since the crane operators could not see inside the building to the installation area. The lifting and placement operation was very challenging, sensitive, and intense throughout equipment erection."

The Kvarnsveden-Andritz project team was able to complete the task safely, on time, and without any major setbacks. "I must say that it was a masterpiece of coordination and communication," Glück says.

▲ The Kvarnsveden Mill in Borlänge, Sweden was built in 1900 on the banks of the Dalälven River. While some of the typical Swedish buildings around reflect earlier times, the production machinery inside Kvarnsveden Mill is modern and efficient.

Energy recovery, environmental efficiency

The state-of-the-art bleaching equipment helps Kvarnsveden reduce its impact on the environment by being efficient in terms of energy and chemicals consumed.

"This mill's carbon dioxide footprint is continually being reduced," says Nygren. "Very early in the 1980's, we installed equipment for efficient heat recovery and for utilizing biofuel in our boilers. With our efficient TMP steam recovery system and two big boilers designed for burning high shares of wood waste, we are in a good situation today. Our internal bark, wood waste, and water treatment sludge is fully utilized as high-value fuel – and has been for over 20 years. Every year we increase the quantity of biofuel that we buy from sawmills and forest operations and convert it to energy."

"The new Andritz sludge press plays an important role in giving us the processing capacity for wastewater treatment," Nygren continues. "The material from all three presses goes directly to the boiler plant."

Performance guaranteed

"Of course, I'm a bit prejudiced," Liendl says, "but I would venture to say that nothing compares with our PHC bleach plants. The world's high-quality SC and LWC paper producers have our technology. With more than 130 PHC bleach plants installed, this indicates that our equipment is well proven."

After intimate mixing of pulp and chemicals in a unique fluffer-type mixer from Andritz, the pulp enters the bleaching tower. Retention time in the HC-Peroxide bleaching tower is two to three hours. Then, the pulp is re-diluted with wash water and fed to the twin-wire press to remove anionic trash. The clean bleached pulp then goes to the stock prep system for PM 8, primarily for the production of the SC magazine paper InnoPress.

"I must compliment the Andritz team on doing a fine job. The new bleach plant has run very well since its start-up in November, and now we are discussing together how to make future improvements." Stenberg says. "We always seek improvements in our pulp quality, energy efficiency, and environmental performance. Currently, we are discussing with Andritz ways to improve some other systems in the mill, over and above what has already been delivered."

"Andritz's bleach plant helps us achieve the pulp quality needed to produce InnoPress which has been very well received in our markets and we are positive about the future of this grade," Nygren says. "The print performance is excellent."

▸▸ find out more at www.fiberspectrum.andritz.com

Revisiting **energy efficiency***

*This article appears by courtesy of McKinsey & Company, a management consulting firm. It has previously been published in "McKinsey On Paper." The authors are Stephen Makris, Engagement Manager, and Mattias Ringqvist, Principal, from McKinsey's Stockholm office. More information can be found at www.mckinsey.com.

As with many energy intensive industries these days, the forest products industry is facing increasing pressure from rising energy costs. This is particularly acute in key developed regions, such as Europe and the U.S., where the industry is already struggling to remain competitive against global players with significant factor cost advantages in other key cost elements. Though the industry has made major strides in increasing energy efficiency, the challenge is as great as ever. However, we have seen that companies can reap significant additional savings from increasing energy efficiency in their operations. To capture these opportunities, companies must reassess energy efficiency programs in light of the new energy reality.

A new energy reality

Energy has become more and more important over the past several years, something the forest products industry has felt in a rising energy share in overall production cost, with annual energy expenditures reaching 25% of operating costs. The key drivers are the combination of rising oil and gas prices, an increasing focus on regional security of energy supply, and increasing concerns for the environment. Energy prices have risen significantly over the last few years, with oil currently trading over $100 per barrel and natural gas prices more than doubling since 2001 to over $6 per thousand cubic feet. World energy markets are more interlinked than ever, with supply shortages in one region – such as refinery downtime from hurricane Katrina in the U.S. or disruptions in Venezuela – quickly having ripple effects on global energy markets. This has made regional security of energy supply a focus for many governments, and led to increasing efforts to diversify energy supply. Compounding this challenge is growing concern over CO_2 emissions and the need to combat global warming. One result is the current call for a greater share of renewable energy in the final energy consumption mix. This could further increase energy costs. For example, many countries in Europe are granting large subsidies to energy producers to make renewable energy economically viable. Eventually, these higher production costs could be passed on to the utilities' customers. The days of low-cost energy clearly seem numbered, if not gone entirely.

An energy-intensive industry

The forest products industry is one of the major energy-intensive industries in the world, and energy is a key cost element driving competitiveness of individual companies. Today, the industry's global energy consumption accounts for roughly 4.1% of total industrial end-use energy demand. Energy intensity does vary by region and product, as shown in the Illustration. These differences highlight that the levers and absolute potential for improved energy efficiency could vary significantly at the firm level.

However, the industry does benefit from a substantial share of self-generated renewable energy, primarily in the chemical pulp segment. Additionally, the forest products industry has a good track record of improving energy efficiency. There has been a substantial increase in the amount of self-generated energy over the past 30 years or so, particularly in the Nordic countries. Over this time, a significant amount of high-cost fossil fuels has also been replaced with low-cost biomass residues. We have also seen a wide adoption of energy-recovery technologies, such as steam hoods and traps, low pressure steam condensers, high-efficiency motors, etc. And perhaps most importantly, there has been a continuing shift to lower energy-intensity papermaking based on recovered paper with advances in deinking and secondary fiber processing technology.

Opportunity to further increase energy efficiency

Though the industry has realized impressive gains, significant opportunity exists to further improve energy efficiency. For example, according to the EIA, the U.S. production of pulp and paper has decreased primary energy intensity by 1% per year over the last 25 years, compared to, for example, 3.6% per year in the European chemicals industry over the last 15 years. It has been estimated (by the Berkeley National Laboratory) that the overall incremental energy efficiency opportunity in the U.S. is roughly 20-30% for the industry. Capturing these savings can have an impact equivalent to 3-5% return on sales. In McKinsey's work we have seen large and profitable improvements from several key levers, particularly:

- *Investments in more energy efficient technologies*
- *New operating procedures*
- *Recovery and reuse of waste process energy internally and externally*

Examples of these opportunities are numerous. Energy efficient technologies are probably the most familiar and well-trodden ground. Among cost-effective technologies with returns greater than 10%, the most prominent are improved drying technologies, enhanced steam systems, efficiently designed motor systems, and combined heat and power generation.

New operating procedures can also pay great dividends. One pulp and paper mill that exemplifies this was operating multiple boilers including an electric boiler to meet steam demand. However, overall boiler utilization was well below 50%, with peak steam demand representing just over 50% of overall boiler capacity. Furthermore, there was more than 100% variance from the average production cost to the high-cost electric boiler capacity. By shutting down the electric boiler and using the excess capacity as true peaking capacity, the mill saved nearly 4% of its total annual energy spend across the entire mill. These savings were largely from reduced electricity and maintenance costs, partly offset by increased gas costs and carbon dioxide fees.

Finally, no matter how efficient the processes and procedures, residual process energy always remains. This "waste heat" can often be reclaimed and reused within the process, or its quality and/or quantity may make it valuable to external "heat sinks." Internally, waste heat can often directly replace fuel needs, such as using low pressure steam to heat air at furnace inlets.

Path forward

To capture these opportunities, companies must look within their operations and beyond. Company-wide energy productivity programs are the first step. We have found that a combination approach – combining capital-driven and people-driven projects, overlaid by new financial evaluation economics – is necessary to drive maximum impact and change mindsets and behaviors of the workforce. A central program office with a few dedicated resources can be an effective means to drive this approach across multiple plants and geographies.

One important finding is that the discount rate for capital projects in such programs needs to be aligned with the inherent project risk. By way of example, energy projects are often times evaluated with the same discount rate as capital projects such as paper machine investments. However, the latter have a much higher project risk due to externalities that may impact the business case for the investments. Energy efficiency projects rarely encounter such risks, and the benefits are therefore more certain. When the discount rate is aligned with this lower risk, many energy projects that otherwise would not have been considered become very attractive financially, in terms of IRR[1] and NPV[2].

In addition to financial metrics, appropriate supporting management infrastructure, such as performance management, benchmarks, "energy efficiency office," and formal or informal networks at all levels in organization, mindsets and behaviors, such as ownership mentality, change stories, and role modeling, and processes, such as idea databases with quantified examples, Kaizen workshops, and Pareto analysis of energy opportunities, are key enablers for capturing the savings. One company used Kaizen workshops on water and steam usage at their mills to eliminate waste and to find and realize the easiest opportunities in water reduction and heat utilization. It also generated high awareness about the cost of steam, heat, and water and brought momentum to all conservation efforts. The savings were over $ 2 million per year.

Finally, internal energy efficiency initiatives should also have clear links to risk management. For example, newsprint mills that optimize the mix of TMP and recycled fiber based on daily input prices need to coordinate with corporate energy price hedging activities.

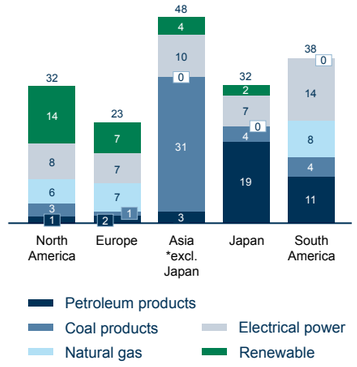
Beyond internal projects, industry partnerships constitute the next step to increased energy efficiency. Examples include research consortia and Best Practice sharing through industry associations to leverage investment funds and accumulated industry knowledge.

Lastly, partnerships outside the forest products industry provide a third approach to tap into unrealized potential, particularly for high risk/high reward technologies or for large infrastructure investments. A key barrier to the adoption of breakthrough technologies is that the learning curve costs are borne largely by the first adopter even for a demonstrated, open market technology. Furthermore, the early adopter often gains little competitive advantage from the initial investment, as any new technology that is successfully deployed rapidly propagates across the industry as highly specialized equipment suppliers seek to monetize their own investments. This discourages efforts to commercialize breakthrough technologies and instead leads companies to concentrate on optimizing existing processes. Partnerships with the government and other industries can reduce or distribute the costs and risks associated with such projects, and foster adoption of breakthrough technologies. For example, government co-investment in black liquor gasification has brought this technology to the industrial pilot stage more rapidly than through the efforts of any individual company. Similarly, co-investing with other industrial partners is another avenue to reduce cost and risk, such as with local utilities to develop grid heating and power generation.

Clearly, there are still opportunities to improve energy efficiency. Given the new energy reality and the fact that energy continues to be an important driver of competitiveness, forest products companies will be wise to revisit all options to capture the economic and environmental benefits of energy savings.

[1] *IRR (Internal Rate of Return): The discount rate that makes the NPV equal to zero.*
[2] *NPV (Net Present Value): An estimate of future cash flows or the value of production to be generated by a project, net of operating costs and expenses, discounted back to present time with a certain discount rate.*

Illustration



Energy mix varies by region (and by end product)

Million BTU per ton produced, Printing & Writing paper – 2005

Source: LBNL; Environment Canada; World Bank; IEA; MGI analysis

“Energy is always **a major cost factor.**”

FiberSpectrum talked with Karl Hornhofer and Humbert Köfler, heads of Andritz’s Pulp & Paper Business, to get their response to the McKinsey article – particularly with regards to the role that technology and service suppliers play in improving energy efficiency.

Authors Makris and Ringqvist from McKinsey say that the days of low-cost energy are numbered, if not gone completely. Are there regional differences that you see?

Köfler: Rising energy costs are crippling some of our customers’ operations. In mechanical pulping, the high costs in Eastern Canada and Northern Europe are stifling. We are now seeing the impact in emerging markets such as China. The one region that seems to be in a better position is Russia, with its abundant wood resources and a surplus of energy. That said, it’s important to stress that energy has always been a major cost factor. As a supplier to the industry, we have focused on energy efficiency for years, since it is a major component of cost.

Hornhofer: With the price of oil now approaching US$ 120 a barrel and dynamic growth in developing economies such as China and India, we don’t anticipate that the cost of energy will become much lower. Security of supply and the efforts to reduce greenhouse gas emissions are placing a big emphasis on biofuels – which puts pressure on wood supplies. We can’t un-bundle the energy discussion from the other major components of cost – where fiber supply, labor costs, other raw material costs, water consumption, and environmental costs enter the picture. These can be seen partially as threats, and partially as opportunities.

The threats are real. How real are the opportunities? The McKinsey authors talk about lower energy-intensity papermaking using recycled fiber as an example.

Hornhofer: The opportunities are very real and vary in their overall impact by the furnish being produced. For example, the electric power consumption of dried chemical pulp is 600-700 kWh/adt (incl. pumping, process equipment, bleaching chemicals, etc.) and the consumption of heat is 11-13 GJ/adt for heating fluids, acceleration of reactions, and evaporation of water. At the same time, a modern kraft mill generates 900-1100 kWh/adt of electricity from its own turbines. So the excess electricity, 200-500 kWh/adt, can be sold to the grid or can be utilized in integrated paper production.

That said, there is still a lot of unutilized low-value heat in flue gases and water/filtrate streams. The wider use of variable speed motors, operating processes as they were originally dimensioned, pre-heating incoming raw materials and air, keeping heat surfaces clean (sootblowing in the boiler, cleaning of evaporator elements, etc.), operating at lower temperature levels, and using steams and condensates all contribute to energy savings.

Köfler: TMP consumes 1500-3300 kWh/adt electric power (refining, pumping, process equipment, and bleaching chemicals). If the line has a heat recovery system, about 3-4 GJ/adt of low-pressure steam is recovered.

From an energy standpoint, recycled fiber processing is the most efficient. Typically, deinked pulp consumes 400 kWh/adt of electric power (pumping, process equipment, and bleaching chemicals) and some 1.5 GJ/adt of heat for heating of fluids. More than half of the world’s papermaking fibers are based on wastepaper recycling. But we can’t base everything on wastepaper. Gradually, we’re reaching the maximum 55-60% recovery rate.
A certain portion of fresh virgin fibers is required to keep RCF quality satisfactory enough for papermaking.

Also, papermakers must balance wood utilization as well. The wood yield from mechanical pulping is about twice that of chemical pulping.

What is Andritz doing to help pulp and paper producers capitalize on their opportunities?

Köfler: Our customers are looking for faster paybacks than they can achieve with conventional investments – typically one year or less. Andritz has technology solutions and services that reduce power consumption, increase energy recovery, and increase the generation of electric power.

One of the simplest solutions for mechanical pulping is to install a heat recovery system. There are still production lines running without this most basic heat recovery. We can recover one ton of steam for every one megawatt of applied energy. Energy savings are in the area of 30%. Another simple solution is the application of the right refiner plate design. By simply making this change, we have seen mills reduce their TMP energy costs by 10% in some cases. The basic refining process RT-RTS saves up to 20% in energy costs (or allows for 20% increased production). Significant savings for hardwoods using the PR-C APMP are also achieved. The pulp quality from these hardwood lines is such that for certain paper grades, it can be substituted for softwood. Energy savings for this conversion is 900-1300 kWh/adt.

We are working now on solutions to extract another 10-20% energy savings using low consistency refining and the addition of special chemicals in the stock preparation process.

In the service area, when our experts go into a mill to perform an audit, we typically see opportunities to reduce energy consumption by up to 5%. We have developed special bearings and new lubricants that reduce energy. We identify idle power consumers and can optimize the pumps to reduce energy consumption. This is all done in cooperation and partnership with the mill.

Hornhofer: One very important way to reduce energy consumption is in the process design and layout stage. A simple process flowsheet with fewer stages will have much lower energy demand. For example, an important step was taken when fine screening was installed after the oxygen stage and coarse screening was also moved to the same position. We innovated a combined fine/coarse screen with multi-stage DD washers. One pump moves the pulp from the oxygen stage blow tank through the screenroom to the post-oxygen washer without any booster pumps. The reject content is lower and screening can be done with three stages and a reject washer – instead of four screening stages.

In the recovery area, our HERB (high energy recovery boiler) considerably improves power generation per tonne of pulp produced and improves the profitability of pulp production with the potential sale of green electricity. We also recover/reuse heat energy by flashing the green liquor from the recovery boiler to generate steam for our ARC chloride removal process.

The transfer of materials (pumping) typically represents 50% of the electric power consumption of a mill. We have introduced a new generation of MC pumps which substantially lower energy consumption.

McKinsey cites industry partnerships as a way forward. They also talk of external partnerships as a way to encourage breakthrough advances in technology. Does Andritz participate in any of these?

Hornhofer: On many occasions we hold seminars with specific customers at a group level to discuss energy efficiency improvements for their mills. In Finland, we are part of national energy programs and work closely with research institutions dedicated to energy issues (such as VTT). Another example is the joint development work we are doing with UPM to gasify forest residues and create second generation biofuels.

Köfler: We also have our periodic user seminars where we provide the forum for customers to share their experience and best practices. With regards to McKinsey’s comments about the monetizing of our R&D investments, there are situations where we do partner the development of a technology directly with a customer. Both parties have to bring something to the development table and then we grant exclusivity to the customer for a defined period of time – often this helps them gain a competitive advantage.

►► find out more at
www.fiberspectrum.andritz.com

“One very important way to reduce energy consumption is in the process design and layout stage. A simple process flowsheet with fewer stages will have much lower energy demand.”

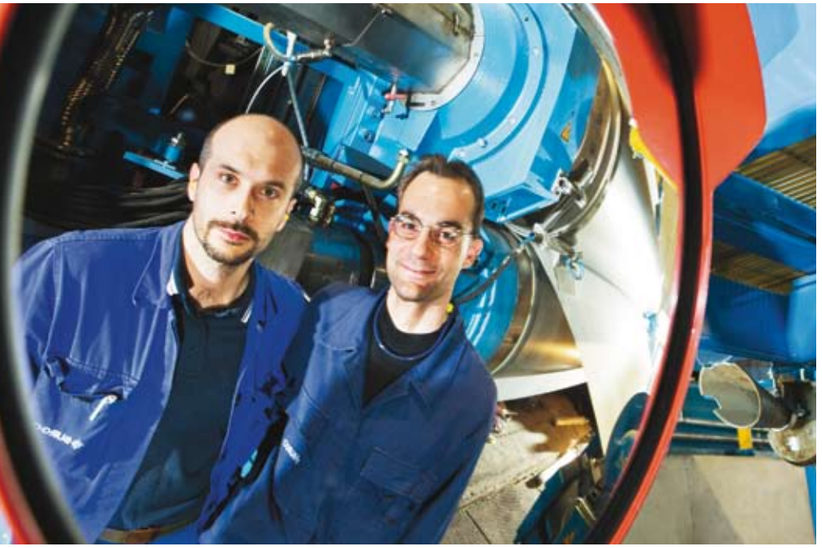
Karl Hornhofer, Member of the Executive Board, Pulp & Paper – Capital Equipment

“In any discussion on energy, papermakers must balance the discussion about fiber supply and utilization as well. These are important considerations and trade-offs.”

Humbert Köfler, Member of the Executive Board, Pulp & Paper – Service and Units

A "systems" approach to efficiency and energy

The Italian Burgo Group's desire to compete in complex markets for its graphics papers has led it to evolve into what they refer to as a "paper industry system" – with activities ranging from paper production, distribution, and recycling, to the production and sale of energy. This systematic approach to business led Burgo to work with Andritz on diverse projects to improve machine efficiency and energy utilization in its mills.



"Usually paper machines suffer a loss of efficiency when changing from offline to online calendering. Amazingly, this did not happen here."

Massimo Beltrame, Production Manager (left) with Matteo Nicoli, Project Manager for the Mantova mill.

The Burgo Group is a "new" company (established in January 2007 with the merger of Cartiere Marchi and Cartiere Burgo) that has been making paper since 1905. With market share of more than 13%, the Group is one of the top four manufacturers in Europe of mechanical and woodfree coated papers. It has 14 production plants (13 in Italy and one in Belgium) with a total manufacturing capacity of 2.9 million t/a. The Group also produces about 2.8 million KWh of electricity, some of which it markets.

This largest Italian paper producer decided several years ago to focus on the **"Big E's"** *of Efficiency, Energy, and customer Expectations* to sustain its business.

For the grades that Burgo produces, there is heavy competitive pressure in Europe. Demand for graphic paper is holding substantially steady, according to Associate Vice President Antonio Stefani, member of the Board and head of the investment department. A number of plant closures only partially attenuated the imbalance between supply and demand. Pricing held generally stable, but did not offset the increased costs for energy and raw materials. "Finding ways to reduce production costs is very important," Stefani says. "We are constantly seeking ways to optimize the energy and raw materials balance, while saving money at the same time. These savings are many times related to investments in new production processes and technologies in many cases. It is a very simple truth that you can only harvest what you have sowed before."

E = Efficiency
PM 1 at Mantova

"Market position and investments in efficiency are two sides of the same coin," says Stefani. "We know that we cannot maintain our leading market position without maintaining the necessary technical processes and machinery."

The most recent project to improve efficiency was the € 15 million investment at Burgo's Mantova (Mantua) paper mill for the modernization of PM 1.

Mantova began producing pulp over 100 years ago, and in 1962 a paper machine was installed for the production of newsprint. Furnish is 100% deinked pulp. Each year, 220,000 tonnes of wastepaper are processed. Paper production capacity is 150,000 t/a of white (standard and flexographic), salmon, and pink newsprint.

Burgo Mantova's Project Manager for the modernization was Matteo Nicoli. "The printing industry is constantly evolving," Nicoli says. "Especially for flexography papers, properties such as smoothness and uniformity of profile and surface are critical. Naturally, we have to stay ahead of our customers' requirements, so we modernized our PM 1."

For paper grades up to 150 g/m², the PrimeFeeder system consists of a flap to cut the paper sheet and as many vacuum conveyors (JetBelts) as necessary. Heavier paper (150 to 600 g/m²) is cut with a shear.

For the modernization, new systems for fiber preparation, a new forming section, and a new Andritz Küsters soft calender, including a web feeding system, were installed. The calender is 7320 mm wide and runs at a speed of 1200 m/min. It consists of a heated roll (surface temperature 120° C) and a PrimeRoll MHV to achieve the best possible control over the paper profile. The calender and feeding system experienced a smooth start-up in May 2007.

Mantova's customers were involved in the modernization process right from the start. "We asked specific questions of them about the change requirements,"

▾ The Andritz Küsters soft calender on PM 1 at Mantova.

Nicoli says, "and they ran printing tests for us to verify the paper qualities."

Nicoli praises the support from Andritz Küsters during the start-up of the new soft calender. "They had all of our machine performance data available to them through a web-based monitoring system," Nicoli says. "So their best experts in Krefeld (Germany) were available to us. That was some kind of experience!"

The modernization has resulted in smoother and more uniform paper profiles. "It seems like we are working with a new machine today," Nicoli says. "Many customers expressed their appreciation for the positive changes in paper quality."

Nicoli finds the new PrimeFeeder from Andritz Küsters particulary noteworthy. "We were a little skeptical at first, because Andritz had not installed a web feeding system before," Nicoli says. But, after a visit to the pilot plant in Krefeld, the skepticism was removed. "They impressively demonstrated how uncomplicated web feeding can be with our paper."

The PrimeFeeder is equipped in such a way that usually three "shots" are sufficient to securely feed the paper web. Regarding more or less typical figures throughout the industry, the average time to restart the machine after a sheet break can be reduced by two to three minutes every time. Multiplied by the average number of production days in a year, that equals nearly 24 hours of increased production time each year.

When asked whether the modernization of PM1 also had an effect on machine efficiency and energy consumption, the engineer nods a careful yes. However, the question of energy consumption can actually only be answered indirectly.

“Because of our history, we have a special relationship to the energy aspect.”

Guiseppe Tagliaferri, R&D Manager for the Burgo Group (left) with Gianfranco Gaiano, Research Manager.

Energy savings for the finishing section is estimated to be about 25% with the soft calender in place. “Although the finishing section is not a major energy consumer on a paper machine, any reduction in our total energy consumption is welcome,” Nicoli says.

Perhaps the biggest surprise for Burgo lay in the machine efficiency. Usually, the use of online calenders leads to a slight loss in machine efficiency. But, at Mantova this did not happen. “We did not experience a loss in machine efficiency through the installation of the Andritz Küsters soft calender,” Nicoli says. “There were marked gains in the ability to control paper profiles.”

E = Energy
Refiner plates at Avezzano

Energy – its generation, utilization, and sale – plays a unique role in Burgo’s development. If you ask Gianfranco Gaiano, Research Manager for the Burgo Group, how the company addresses energy issues, he will reply, “With the utmost dedication.” Never, he would add, would the need to save energy be disputed. “Because of our history, we have a special relationship to the energy aspect.”

Italy is the European country with the highest electricity prices. Renewable resources like wind, water, or biomass play an increasingly important role in the country’s energy scenario. Burgo has a history of water and biomass for energy production. Company founder Luigi Burgo started to build the first hydroelectric power plant, which also generated power for the Verzuolo paper mill, in 1905. Since then, it has become characteristic for the company to invest in an own energy supply whenever possible.

Energy production within Burgo (including its hydroelectric and cogen facilities) is sufficient to meet the energy requirements of its mills. In this context, the Group operated an “Energy System” in Italy of around 4.8 billion KWh. The energy business unit, Burgo Energia, handled approximately 1.8 billion kWh, buying and selling on the Italian electricity exchange and the bilateral trading market.

Gaiano and a colleague, Guiseppe Tagliaferri, are studying a move to include more short-fiber eucalyptus in the furnish. They ran a trial recently using Andritz’s LemaxX Spiral™ refiner plates. The trials were carried out at the Avezzano Mill, around 100 km east of Rome. The mill specializes in double- and triple-coated woodfree papers and has several refining lines. “With multiple lines, we were able to run our tests without interrupting paper production,” Gaiano says.

The two factors – raw material and energy consumption – constitute a huge component of production costs, according to Gaiano. “If we can positively change both factors at the same time, of course this is of great interest to us.”

Conventional plates have grooved bars in concentric, parallel patterns around the plate. The crossing angle (angle between plate and fiber) fluctuates depending upon where the fiber is positioned on the plate. The bars in the LemaxX Spiral™ plate are arranged in a spiral shape. This maintains a consistent crossing angle regardless of the fiber position on the plate. The design of the LemaxX Spiral™ produces very good refining results with significantly lower energy consumption.

“When it comes to using short-fiber raw materials, we still have a thing or two to learn,“ Gaiano says. “We want to deepen our understanding of the behavior of short-fibered pulp under different conditions and see what that means for our production and the energy balance.”

The specific characteristics of eucalyptus fiber after refining were studied. Fiber length, specific volume, Gurley porosity, tensile strength (tensile index), tear propagation, strength (tear index), and firmness according to Scott Bond were meticulously measured, as well as opacity and the light scattering coefficient. All tests were run at different speeds to study how the fiber characteristics would change as production speed was accelerated. Gaiano is positive that the results from the LemaxX Spiral™ trials will be very interesting for those Burgo mills that process short fiber furnishes.

E = Expectations
Customers and Andritz

In terms of customer expectations, Stefani explains that one of Burgo’s strengths is the complete range of graphic papers it produces. “We offer coated and uncoated papers with finishes and characteristics that meet the various specific needs of the graphics and publishing sectors.”

With this in mind, the Group has been expanding its range of uncoated and coated papers with FSC mixed sources certification, and introduced coated woodfree papers with PEFC (Program for Endorsement of Forest Certification). These certifications indicate that the paper is being produced with fibers originating in forests managed in an environmentally responsible manner and with an eye to protecting biodiversity.

And, concerning expectations working with Andritz? “The LemaxX Spiral™ trials and the calender and PrimeFeeder for Mantua were not our first projects with Andritz,” Gaiano says.

Not too long ago, when he had temporarily changed from research to project management for modernization and construction projects, Gaiano was responsible for a PHC bleaching project delivered by Andritz to the Duino mill. “I remember the installation of the bleach plant very well,” Gaiano says. “It went really smoothly and was a good project.”

Experience with Andritz in the finishing section of the paper machine was gained before the Mantua project. In 2006, Andritz Küsters installed a hard-nip calender in Cartiere Toscolano, and has installed several swimming rolls over the years for calenders that did not originate from Andritz Küsters.

►► find out more at www.fiberspectrum.andritz.com

▼ Friendly prospects for the LemaxX Spiral™ refiner plates: The test results indicate energy-saving performance with excellent fiber quality. From left to right: Gianfranco Gaiano, Michael Jarolim, Andritz Project Manager, and Guiseppe Tagliaferri.

New **Orders**

▶ Complete Lines

Wood Processing

Complete Lines & Systems

Mondi Syktyvkar Pulp and Paper
Komi, Russia
Complete high-capacity debarking plant with two lines
Largest HHQ-chippers in the world

Pfleiderer MDF
Novgorod, Russia
Complete woodyard for MDF plant
Debarking line with RotaBarker™ technology

Key Equipment

Finnforest
Kyröskoski, Finland
Thickness screen with disc screen technology

Guangxi Jingui Pulp & Paper
Qinzhou, Guangxi, China
Three CantiScrew™ reclaimers for chips

Kotlas
Archangelskaja, Russia
Rechipper

Fiberline

Complete Lines & Systems

Mondi Syktyvkar Pulp and Paper
Komi, Russia
Downflow Lo-Solids® cooking with TurboFeed® chip feeding system; washing with pressure diffuser and DD washer; bleaching with new A and D-stages and DD washer
First A-stage in Russia

Recovery

Complete Lines & Systems

Mondi Syktyvkar Pulp and Paper
Komi, Russia
Recovery boiler and evaporation plant

MeadWestvaco
Evadale, Texas, USA
Ash leaching chloride removal
The first chloride removal system in the U.S. that leaches the ash from the recovery boiler precipitator

Portucel Empresa Produtora de Pasta e Papel
Setúbal, Portugal
Biomass power boiler

Portucel Empresa Produtora de Pasta e Papel
Cacia, Portugal
Biomass power boiler

Key Equipment

Visy Pulp & Paper
Tumut, Australia
Liquid methanol plant

Upgrades & Modernizations

Weyerhaeuser
Columbus, Mississippi, USA
Recovery boiler retrofit

Chemical Systems

Upgrades & Modernizations

Ripasa Celulose e Papel
Limeira, Brazil
LMD+ for lime kiln
New technology for lime mud drying boosts lime kiln production over 20%

Mechanical Pulping

Complete Lines & Systems

Yanzhou Yongyue Paper Industry
Yanzhou, Shandong, China
P-RC™ APMP system
Repeat order

Papierfabrik Louisenthal
Königstein, Germany
Bleach plant for cotton combers based pulp
Repeat order

Upgrades & Modernizations

JSC Kama
Krasnokamsk, Russia
Mill audit to investigate an upgrade of an existing TMP line to the advanced energy efficient P-RC™ APMP technology

Panelboard

Complete Lines & Systems

Pfleiderer MDF
Novgorod, Russia
Fiber preparation system for MDF, incl. a woodyard, a chip washing system, and a pressurized refining system with 1248 t/d capacity
Delivery nearly on turnkey basis, 3rd order from Pfleiderer Group for Europe

Pfleiderer Holzwerkstoffe Nidda
Nidda, Germany
Pressurized refining system for MDF with 528 t/d capacity

Anhui Huqian Investment & Industry
Fu Nan, Anhui, China
Fiber preparation system for MDF, incl. a woodyard, a chip washing system, and a pressurized refining system with 672 t/d capacity

Floraplac MDF
Pará, Brazil
Pressurized refining system for MDF with 384 t/d capacity

Yingang (Hubei) Wood Based Panel
Suizhou, Hubei, China
Pressurized refining system for MDF with 864 t/d capacity

Baoshan Corporation (Group)
Pengzhou, Sichuan, China
Pressurized refining system for MDF with 600 t/d capacity

Hunan Xianglin
Changsha, Hunan, China
Pressurized refining system for MDF with 432 t/d capacity

Yingang (Sichuan) Wood Based Panel
Hedong, Sichuan, China
Pressurized refining system for MDF with 720 t/d capacity

▶ Key Equipment

Fiber Preparation

Complete Lines & Systems

Yueyang Paper (A company of the Hunan Tiger Forest & Paper Group)
Yueyang, Hunan, China
Deinking line with 550 t/d capacity incl. sludge handling system, stock preparation systems, and paper machine approach systems
Superior deinking technology and the ability to process MOW furnishes with very high energy efficiency

Diana Joint Stock Corporation
Hanoi, Vietnam
Deinking line with 70 t/d capacity for the production of tissue

Latif Paper
Tehrán, Iran
Rebuild of the deinking line with 100 t/d capacity, including sludge handling, for the production of high-quality facial tissue

Portucel Empresa Produtora de Pasta e Papel
Setúbal, Portugal
Stock preparation system and FlyingWing Deculator®

Key Equipment

SCA Tissue
Menasha, Wisconsin, USA
FibreFlow® drum pulper

IPUSA Industria Papelera Uruguaya (A company of CMPC Tissue Chile)
Pando, Uruguay
Recycled fiber processing plant with 130 t/d capacity and stock approach flow equipment for tissue

Dong Hai Joint Stock Company of Bentre (DOHACO)
Ben Tre, Vietnam
OCC and paper machine approach flow components

Phong Khe Paper Enterprise
Bac Nihn, Vietnam
Stock preparation components

Taizhou Xinyuan Electronic Equipment
Jiangsu, Taizhou, China
Stock preparation components

Nanping Paper
Nanping, Fujian, China
Stock preparation and paper machine approach equipment for PM6

Armstrong Building Products (Shanghai)
Shanghai, China
Stock preparation components

La Rochette Vénizel (A company of the SAICA Group)
Vénizel, France
ShortFlow equipment

UPM Kymmene
Rauma, Finland
Andritz disc filter ADT55

Palm Paper
King's Lynn, Norfolk, Great Britain
Sludge handling system

Papelera Alier
Rossello (Lleida), Spain
FibreFlow® drum pulper

Upgrades & Modernizations

SCA Graphic Laakirchen
Laakirchen, Austria
Deinking line components for capacity increase of existing line

Paper Machines

Complete Lines & Systems

Saigon Binh Dinh Paper
Ba Ria Vung Tau Province, Vietnam
PrimeLine tissue machine including steel Yankee

Key Equipment

Sappi Austria
Gratkorn, Austria
Installation of sheet stabilizers for two existing paper machines

▶ Upgrades and Modernizations

Upgrades and Modernizations

Latif Paper
Tehrán, Iran
Rebuild of 12 year old tissue machine

Mondi Packaging Cartonstrong
Monza, Italy
Upgrade of the existing paper machine, new PrimeFlow headbox

Cartiere Modesto Cardella
San Pietro, Italy
Rebuild of the former section

Paper Finishing

Complete Lines & Systems

Burrows Paper Corporation
Little Falls, New York, USA
PrimeCal Hard calender for specialty MG papers

Stora Enso Fors
Fors, Sweden
PrimeCal Hard calender and PrimeFeeder for board

Key Equipment

Hardayal
Delhi, India
PrimeRoll S with hydraulic unit

KR Pulp & Paper
Delhi, India
PrimeRoll S

Recent **Start-ups**

▶ Complete Lines

Wood Processing

Complete Lines & Systems

Ningxia Meili Paper
Zhongwei, Ningxia, China
Woodyard equipment for APMP

Mondi Packaging
Frantschach, Austria
Debarking and chipping line

Key Equipment

Yanzhou Heli Paper Industry
Yanzhou, Shandong, China
Three CenterScrew™ slewing screw reclaimers for chip handling

Recovery

Complete Lines & Systems

Yanzhou Heli Paper Industry
Yanzhou, Shandong, China
Zedivap® APMP (BCTMP) effluent evaporator

Lwarcel Celulose e Papel
Lençóis Paulista, Brazil
Ash leaching chloride removal

Key Equipment

Stora Enso
Varkaus, Finland
Digester reboiler

Upgrades & Modernizations

Australian Paper
Maryvale, Australia
First step of a double-drum recovery boiler modernization

Svilocell
Svishtov, Bulgaria
Recovery boiler and evaporation plant retrofit

Chemical Systems

Complete Lines & Systems

April
Kerinci, Indonesia
LMD lime kiln
Capacity 1000 t/d

Irving P&P
St. John, Canada
LMD lime kiln

Upgrades & Modernizations

Irving P&P
St. John, Canada
Recausticizing upgrade

Mechanical Pulping

Complete Lines & Systems

Ningxia Meili Paper
Zhongwei, Ningxia, China
P-RC™ APMP refining system for 300 admt/d
First APMP line in Ningxia province

Yanzhou Yongyue Paper Industry
Yanzhou, Shandong, China
P-RC™ APMP refining system for 260 bdmt/d
Fast ramp-up: after 4 weeks system is operating at design throughput and reaching guarantee values

Stora Enso Kvarnsveden
Borlänge, Sweden
Mechanical pulp HC bleaching system for 360 admt/d
Fast-track project – less than one year from contract to full production

Upgrades & Modernizations

Norske Skog Industrier
Halden, Norway
Upgrade of bleaching system

Panelboard

Complete Lines & Systems

Bajaj Eco-tec Products
Kundarkhi & Paliakalan, India
Two pressurized refining systems for MDF with 228 t/d capacity each
First order for Andritz in India for processing bagasse as raw material

Shangqiu Dingsheng Wood Industry
Shangqiu, Henan, China
Pressurized refining system for MDF with 312 t/d capacity

Sichuan Shengda Forestry Industry
Chengdu, Sichuan, China
Pressurized refining system for MDF with 384 t/d capacity

Yuncheng Xinyuan Junda Wood Industry
Yuncheng, Shanxi, China
Pressurized refining system for MDF with 312 t/d capacity

Fiber Preparation

Complete Lines & Systems

Stora Enso Huatai (Shandong) Paper
Dongying, Shandong, China
Complete deinking line for newsprint including sludge dewatering, and stock and water system

Shandong Chenming Paper
Shouguang, Shandong, China
Deinking line with 550 t/d capacity and sludge dewatering system

Fripa Papierfabrik
Miltenberg, Germany
Stock preparation system for tissue machine

ICT Poland
Kostrzyn, Poland
Stock preparation system for tissue machine

Key Equipment

Guangzhou Paper
Guangzhou, Guangdong, China
Wastepaper pulping system with 1750 t/d capacity and sludge dewatering system for 1360 t/d deinking line

Paper Machines

Complete Lines & Systems

Fripa Papierfabrik
Miltenberg, Germany
Complete turnkey installation of a PrimeLineCOMPACT tissue machine including stock drying technology
Successful start-up of the world's first PrimeLineCOMPACT

▶ Upgrades and Modernizations

ICT Poland
Kostrzyn, Poland
PrimeLine CrescentFormer tissue machine with 5.55 m working width
3rd repeat order from ICT

Confidential customer
Sweden
PrimeLine CrescentFormer tissue machine
First installation with PrimePress XT

Paper Finishing

Complete Lines & Systems

Confidential customer
Sweden
PrimePress XT

Ningxia Meili Paper
Zhongwei, Ningxia, China
PrimeCal Hard and PrimeCal Soft calenders
First support from Andritz Foshan during the assembly

Key Equipment

Yodogawa Steel Works
Osaka, Japan
11 shafts with elements for PrimeRoll MHV

Upgrades & Modernizations

Stora Enso Hylte
Hyltebruk, Sweden
PrimeRoll HV
Successful start-up of energy saving roll: up to 40% less energy consumption

Nonwoven

Sefar
Heiden, Switzerland
neXcal XT calender for compacting and glazing of technical textiles and filter material
Successful start-up of multi-functional and precise compacting and calibrating calender

Ascania
Aschersleben, Germany
neXcal calender with 2 Hot S-rolls, 7300 mm roll width, 800 m/min production speed for spunbond nonwovens
Successful start-up of world's widest nonwoven calender

▶ Key Equipment

Andritz **Local Service Centers**

Andritz is focusing on the expansion of its network of service centers in order to strengthen the resources available to customers locally. The goal is to have the right combination of trained people, tools, and capabilities in place to provide quality service at an affordable price.

Additional knowledge and experience based on the Group's joint venture with Sindus Andritz, a leading supplier of maintenance services for instrumentation and automation in South America, is now being incorporated to Andritz's local service capabilities.

Examples of expanded capabilities in Europe include the Service Center South (in Graz, Austria) and Service Center West (in Düsseldorf, Germany and pictured here), which were established in 2005 and 2006. Additional Service Centers in France and the U.K. were established in 2007. Plans for further geographic expansion are underway.

www.andritz.com

Getting ahead

...with Andritz drying technology

Optimized drying of all paper grades and efficient use of energy through innovative air technologies.

PrimeDry Systems for paper and board drying increase the water evaporation of the entire drying section. For tissue, high-temperature hoods and high-precision Yankees (cast or steel) allow excellent drying rates. The TAD hood and air system provide uniform drying of premium quality tissue and towels. Each component of the PrimeDry Systems has its unique strengths to move your products ahead.

We accept the challenge!

ANDRITZ

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