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Stéphane Richard

The good vibes of fibres

Despite the pessimistic market outlook for the rest of the year delivered in this issue by StepChange Consulting, the full potential of the global fibre-based products industry has not been unleashed yet.

If the printing and writing segment continues to decline, the shift from plastics to paper and board in the packaging sector is still progressing. Designers find this material well adapted to the latest legal and ESG requirements, as innovation in functional and barrier coatings is very dynamic and helps positioning paper products when transparency and hydrophobic properties are requested, especially in food packaging. The opportunities in that respect have been reviewed by Smithers in a recent market report.

A sure thing is that production volumes will keep growing globally, along with the demand for fibres, a natural resource that might become a victim of its own success. For that reason, the future of non-wood fibres is bright, especially for tissue products. Bagasse, straw, and bamboo for instance are currently experimented as raw material for new bioproduct technologies.

Are all fibres equal when it comes to sustainability? That is the interesting question a consortium of industry players and academics from the North Carolina State University is currently working on. And the Life Cycle Assessment of a bio-based material like pulp needs to be challenged. In that respect, the study commissioned by Metsä Fibre last year surprisingly shows that virgin fibre can be less harmful for the environment in some ways than recycled fibre. On the technology side, our Tech Talk with Voith reveals how digitalization and automation can contribute significantly to conserving energy and fibres.

On the technology front, our Tech Talk with Voith highlights how digitalization and automation can make a significant contribution to energy and fibres conservation, and thus help produce a more sustainable paper.

There is no impact-free industrial activity. The issue is to minimize the effects of any production. In that respect, our industry is an excellent performer. As described in the series of technical insight published in this edition, the pulp and paper manufacturing process is improving every day through more efficient dewatering and drainage, energy efficiency, quality control, digitalization of logistics or coatings applications.

Enjoy the read.

Stéphane RICHARD

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45000 Orléans (FRANCE)
Tel : +33 238 42 29 00 - www.paperfirst.info
info@groupenp.com
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Publishing Director

Stéphane RICHARD

Editorial Contributors

Ivana AZUAJE, Amelys BRITO, Peter CURA,
William DANNELLY, Kaj FAHLLUND, Naycari
FORFORA, Lotta FORSSELL, Diego FORT, Jorge
FRANCO, Ryen FRAZIER, Stephanie GONGORA,
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TIMAR, Fernando URDANETA, Isabel URDANETA,
Ramon E. VERA, Keren A. VIVAS, David
WOLFANGER

Consulting Editor

Teresa PRESAS

Revision

Zoe WELLENKAMP

Graphic Design

Gessica CAMBI

Marketing and Sales

François HENIN

Printed in Europe

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PaperFIRST Mag is dedicated to pulp and paper professionals. Those who work for a paper mill can be entitled to a free copy. To make sure you receive your own copy, apply for a subscription by sending an email to: paperfirst@groupenp.com.

Moving forward towards more autonomous operations



More and more companies aim to increase the autonomy of their mill or plant operations. In an autonomous mill or plant, an autonomous system can monitor its own performance, which brings several benefits, like improved safety and efficiency, lower costs and reduced environmental impact. Digitalization and more autonomous operations also mean that there is less need for human intervention. The role of people will continue to be important, evolving towards supervising and ensuring that different process areas perform well together, and towards managing exceptions. Operations and maintenance work will become more collaborative in the future as well.

Whether you are just beginning your digital transformation journey or you're further along in the process, Valmet's framework helps you recognize the necessary steps and building blocks. Our experts are there to support you as you move towards more autonomous and optimized operations.

More on valmet.com/autonomousoperations





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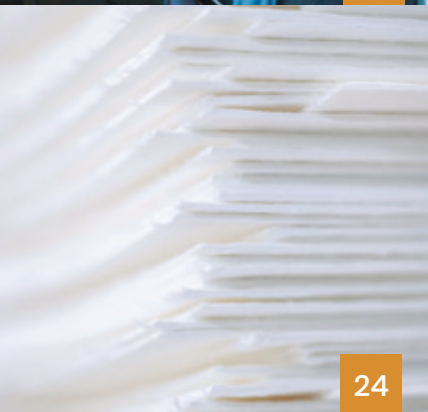
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A pessimistic outlook with a nuance of hope

Article by **StepChange Consulting**
Results from Q1-2023 StepChange Economic Outlook Industry Study

At the end of last year, StepChange Consulting issued a global industry outlook promising a severe economic downturn. Despite the confirmed challenging environment, the firm's latest update instilled hope for the future.

The following publication is based on the global economic outlook study conducted in March 2023 amongst top managers and decision makers in the wider forest products industry (wood, pulp, paper, packaging, tissue). Additionally, participants of the Fastmarkets Forest Products Europe Conference 2023 were surveyed. Over 81% of the respondents are top executives or in managerial roles (68% and 13% respectively).

The aim of the survey is to gauge the sentiment of the respondents regarding macroeconomic expectations for 2023 as well as corporate trends and priorities. The second part of the survey is dedicated to the subject of digitalization and sustainability.

HIGHLIGHTS OF THE STUDY

- Macroeconomic outlook continues to be bleak
- Industry expectations slightly improved versus survey from November 2022
 - Demand and selling prices expected to fall
- Energy, transportation, and raw material expected to decline
- Reduced availability of financing expected
- Companies focus on margin management and cost cutting while business developing initiatives are placed on the back burner
- Digitalization and environmental aspects among the top long-term factors that will influence the industry
- Companies focus on digitalization initiatives that offer cost reduction potential
- Barriers to digitalization are mostly related to change management and IT infrastructure
- Sustainability gives companies a competitive edge, both among potential clients and on the labor market.

DREARY MACROECONOMIC OUTLOOK

The general macroeconomic outlook sentiment remains at multiyear record lows although higher than in November 2022. A vast majority of respondents predicted that the economy in their region would either stagnate or further deteriorate [see Figure 1].

The outlook related to the particular sectors of the PPP industry is even less optimistic. Most respondents in paper & paperboard manufacturing expect to see a decline in their segment, although results in the converting sector are marginally bright, with 20% predicting an upward development. The outlook for the wood segment is the most negative [Figure 2].

An analysis of market-related trends indicates most respondents expect a recessive environment in 2023. Demand, selling prices and the availability of financing are expected to plummet. Input costs for energy, transportation and raw materials are expected to decline by a majority of participants - a trend that was already visible in the previous Economic Outlook. The most notable change compared to November '22 are energy costs. Additionally it can be seen that more strategic trends are expected to be up again (M&A, Sustainability, Digitalization) [Figure 3].

2022 has been marked by economic disruption resulting from the war in Ukraine and post-pandemic supply chain impacts. Nevertheless, industry profitability re-

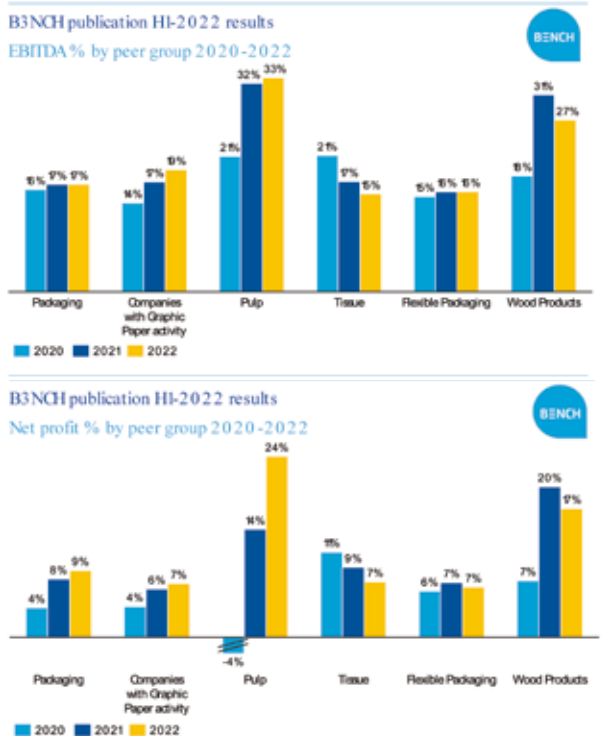


Figure 4: 2020-2022 EBITDA & Net profit % by B3NCH peer group

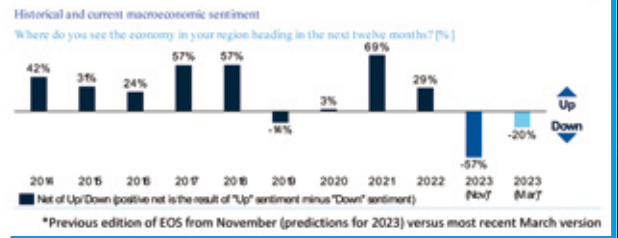


Figure 1: Macroeconomic development

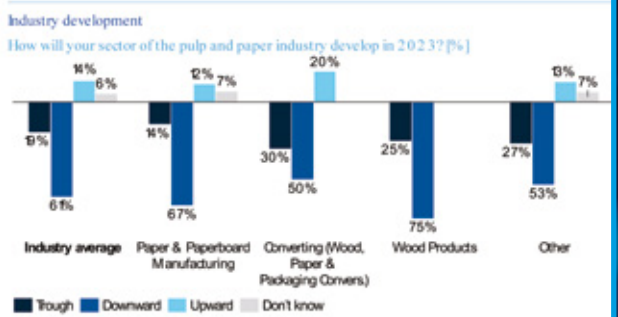


Figure 2: Outlook on industry segment development

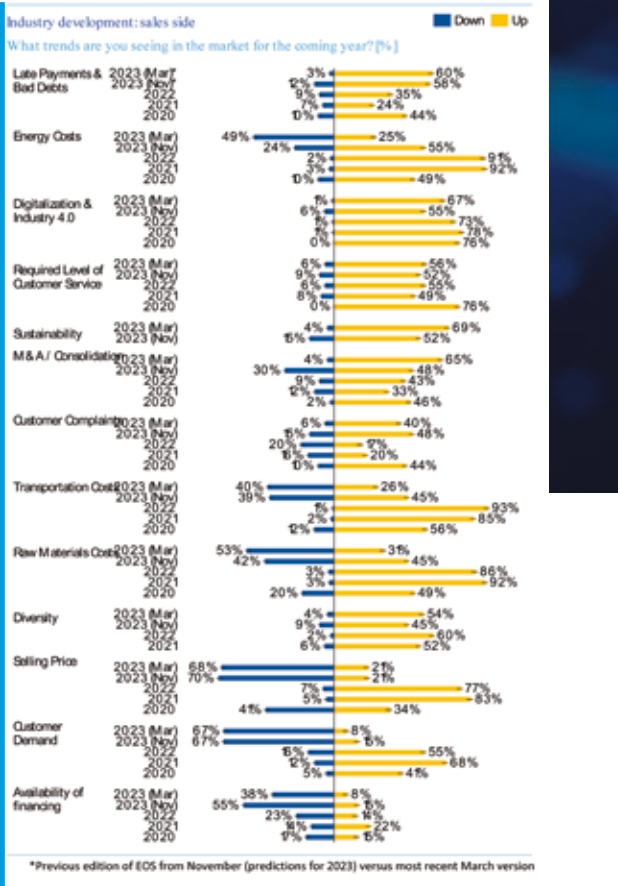


Figure 3: Industry trends

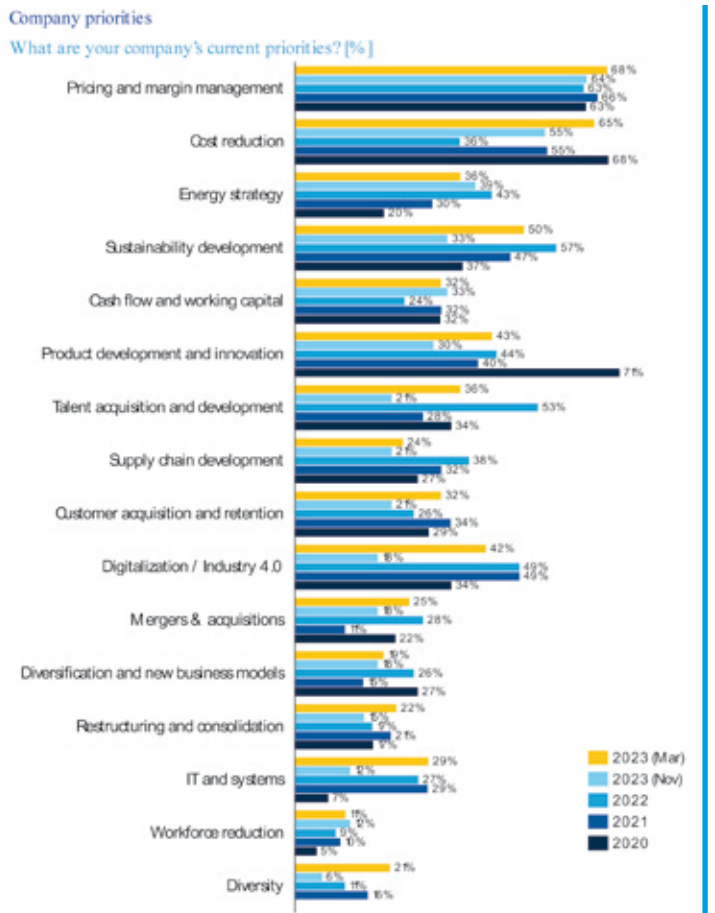


mains very high. The latest StepChange B3NCH publication shows that despite difficult market conditions, the pulp and graphics segment managed to further improve the already high EBITDA % in 2022. The packaging peer group remained stable at a high level. Net profits were up in 3 out of 6 segments. The pulp segment further improved to new record net profit levels [see Figure 4].

The expectation of a challenging market environment is reflected in a shift in company priorities for 2023 [see Figure 5]. Although pricing and margin management remains at the top for most peers, cost reduction has made a comeback now after sliding in priority in recent years.

Forward facing and business expanding initiatives, such as digitalization, sustainability, product development remain high on the list of company priorities, although their relevance has lessened slightly in comparison to previous years.

Energy strategy, which was the 3rd priority in the previous survey conducted in November 2022, has dropped substantially in the list



*Previous edition of EOS from November (predictions for 2023) versus most recent March version

Figure 5: Historical comparison of current priorities

of priorities since then. This further supports the sentiment that energy prices peaked in 2022 and there is potentially less focus on energy now.

Short-term priorities are not exactly aligned with long-term industry expectations. In a longer perspective, strategic topics such as digitalization and sustainability will play an important role in shaping the industry. Both drivers are expected to have a mostly positive or very positive influence on the industry [see Figure 6].

Respondents see geopolitics, energy costs and legislation, new production capacities and imports as being the most important drivers with a negative impact. Due to the long-term relevance of digitalization and sustainability they are explored in more detail in later sections of this publication.



Figure 6: Main drivers and influence expectations

DIGITALIZATION FOCUS SHIFTS

Digitalization is back on the agenda (compared to the Nov. 22 survey) and continues to be a major area of focus for most companies, although to a slightly lesser extent than in previous years [see Figure 5: Historical comparison of current priorities].

With regards to focus of Digitalization projects, digitalization of administrative processes ranks on top followed by production processes [see Figure 7]. A likely explanation is that digitalization in administration processes is typically more easily implementable, and solutions tend to be readily available. Smart products and machinery rank last, while Supply Chain and Marketing receive medium priority.

With regards to expected benefits from introducing digital solutions, productivity and cost reduction rank on top followed by energy efficiency with a surprisingly big gap. Energy efficiency has ranked higher in previous surveys. New business models and sales have a surprisingly low perceived benefits with, products and sustainability at the bottom of the list of benefits [see Figure 8].



Figure 7: Digitalization projects

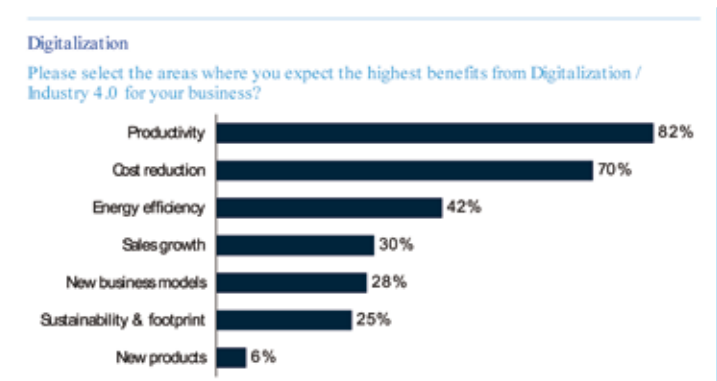


Figure 8: Expected benefits from digitalization

With regards to barriers to digitalization, two main drivers remain in the top three. Cultural and organizational barriers remain on top as well as existing IT systems and Infrastructure [see Figure 9 in the next page]. Security and calculating ROI additionally remains a challenge. Securing financing is not considered to be a barrier in the introduction of digital solutions anymore. Earlier studies pre 2019

had this topic identified as a main barrier. This indicates that it is commonly understood that investments in digitalization are essential even though the ROI might not always be immediate. Digitalization plays a key role in sustainability as well. However, only slightly over 50% of respondents have access to tools that can provide integrated and automated measurement of sustainability performance [see Figure 10].

SUSTAINABILITY A SOURCE OF COMPETITIVE ADVANTAGE

The results demonstrate that sustainability focus is further increasing, despite challenging market conditions. Over 83% of companies have defined a sustainability strategy that will help them reduce their footprint [see Figure 10]. The share of respondents that track their footprint has also increased since November.

Although noticeable improvements are being made, there remains a long road ahead to becoming carbon neutral with regards to energy sources. It is worth noting, however, that in direct comparison to the previous study the focus on renewables has increased again [see Figure 11]. Especially some European companies had to temporarily take a step backwards in 2022 to substitute energy demand during the disruption in energy markets caused by the war in the Ukraine.

Interestingly, more and more respondents are viewing sustainability as a competitive advantage even though it doesn't pay off in terms of financial returns.

The benefit of a sustainability strategy is also seen as a lever to attract and retain talent, as environmental awareness is increasing, especially among younger generations. [see Figure 12].

SUMMARY & OUTLOOK: CHALLENGES & OPPORTUNITIES AHEAD

A financially strong 2022 leads into an uncertain 2023 for most companies in the industry. Com-



Figure 9: Barriers to digitalization

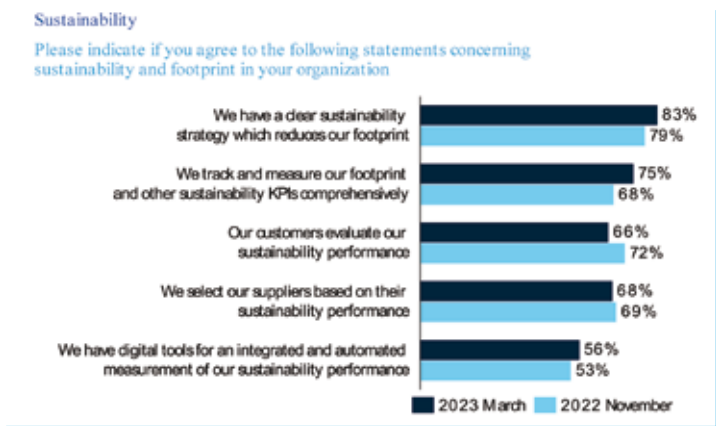


Figure 10: Sustainability strategy perception

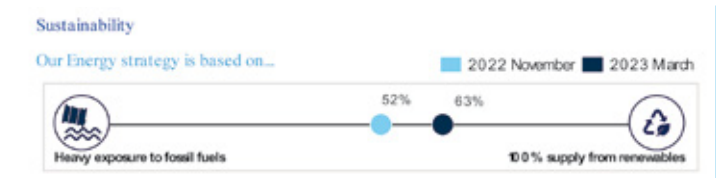


Figure 11: Energy strategy [% of Renewable energy planned to be used]



Figure 12: Benefits of increasing sustainability

panies prepare themselves for a gloomy future while trying to lead companies forward.

- Significant decline of demand and sales prices indicate a recessive environment
- Input costs are expected to decline
- Priorities have shifted towards housekeeping, i.e. cost cutting and price & margin management
- Manager focus longer term again with strategic topics such as digitalization, sustainability and M&A back on the agenda
- Digitalization as a topic is undisputed even though many challenges still exist from choosing the right projects and capturing benefits
- Sustainability focus is increasing and the topic is perceived as a differentiator
- Building a sustainable business model will secure future clients and employees, while at the same time hedging against regulatory changes
- Geopolitics is the key single driver with a perceived negative influence on further growth and development

While the industry is used to cyclical it is currently subject to strong headwinds such as inflation, increasing interest rates (in a capital-intensive industry) and declining demand combined with overcapacities in some segments. However, input costs are expected to decline further therefore mitigating some of the effects. With all these headwinds, the threat of a perfect storm remains, but potentially with less adverse effects than perceived just a few months ago.

ABOUT STEPCHANGE CONSULTING

StepChange is an industry focused and independent management consulting company with a proven track record in supporting clients to achieve sustainable value. StepChange provides support to top tier organizations in the industry from strategy development to implementation of operational improvements.

StepChange is further an industry thought leader in digital strategy on the forefront of bringing digital transformation to the fiber value chain.

With an international team of industry experts StepChange will hit the ground running. StepChange provides innovative and yet pragmatic solutions, placing an emphasis on delivering measurable business results.

Smithers tracks new opportunities for fibre-based packaging

Article by *John Nelson, Editor, Smithers*

With greater sustainability the central mission for packaging designers across the 2020s, there is a clear impetus in many segments to replace plastics with paper, board, or other fibre-based materials

With greater sustainability the central mission for packaging designers across the 2020s, there is a clear impetus in many segments to replace plastics with paper, board, or other fibre-based materials. Combined paper-based packs are the most widely used materials in the packaging market. Data from the Smithers study – *The Future of Fibre-based Packaging to 2027* [<https://www.smithers.com/en-gb/services/market-reports/packaging/the-future-of-fibre-based-packaging-to-2027>] – show that in 2022 various paper pack types were worth a total of \$425.3 billion worldwide. This is equivalent to 40% of all packaging demand by value.

The only material segment that can approach this is plastics, where flexible and rigid formats combined account for 37% of the contemporary market.

Both paper and plastics have well defined segments suited to their different material properties – paperboards offer good impact resistance in transit, and on primary packs good print surfaces and easy recyclability. Plastics are easily moulded into a wide array of shapes while presenting a strong barrier to moisture, oxygen, or odours; but are much harder to recover and process at end-of-life.

In 2022, Europe consumed 52.98 million tonnes of fibre-based packaging Smithers research shows, with a value of \$95.79 billion.

MARKET DRIVERS & CHALLENGES

Many leading FMCG firms have signed commitments to make all of their packaging portfolios – fully recyclable either by 2025 or 2030. While the phrasing ‘fully recyclable’ is opaque and open to multiple interpretations, when it comes to demonstrating their environmental credentials to consumers most are prioritising recyclability.

While there have been limited trials with metal packaging – replacing PET bottles with aluminium cans in applications like mineral water – the main emphasis is on paper formats to replace plastics. Surveys show consumers generally recognise paperboard as recyclable, and are keen to see more of the packaging they handle made from this.

The transition to paperboard packaging has received extra impetus from single-use plastic legislation, initially passed in Europe, but now propagating across the world. Additional targets are set to be

imposed when the European Union adopts its reform of the Packaging and Packaging Waste Directive. The final draft of this is now under consideration; and includes increased recovery targets for all packaging types, minimum post-consumer recycled content levels, and new design for recyclability rules.

The central challenge for paperboard manufacturers is to design functional packs that can replace polymers with a suitable level of performance, and without compromising the recyclability of the base material. The technical demands this sets mean that penetration is happening at different rates in different segments; and requires new R&D solutions.

Below Smithers reviews the prospects for developing these, to meet the wider vision for genuinely sustainable, functional paperboard packaging.

CORRUGATED AND FOLDING CARTONS

Corrugated boxes and folding cartons represent the majority of contemporary paperboard packaging demand in Europe. They held a combined market share of 78.6% by weight in 2022, when consumption totalled 41.6 million tonnes.

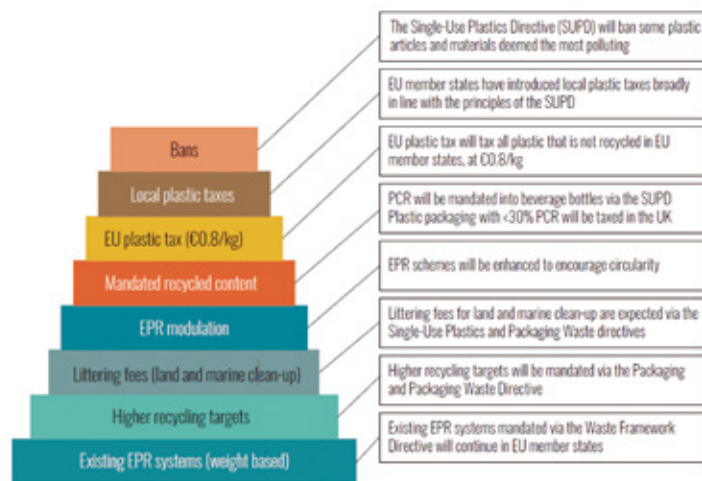
Folding cartons and corrugated already have a strong market penetration and where paperboard can be used instead of plastics, this is already often done. Consequently, there is a need for innovation to open new segments.

Some converters have introduced cartonboard packs with polyethylene (PE) film layers for more sensitive goods, but these need to be removed before the paper fibre itself can be recycled. Instead the greatest desire is for better functional and barrier coating technologies for paperboard, preferably water-based, that can be repulped once the pack enters a recycling stream. Preliminary data from the forthcoming Smithers study – The Future of Functional and Barrier Coatings for Paper & Board to 2028 – show that in 2022 global consumption of these reached 3.3 million tonnes (weight of coating materials) and a value of over \$9 billion.

R&D priorities now include developing coatings from micro-fibrillated cellulose (MFC) or new biopolymers, such as polyethylene furanoate (PEF).

To be a genuinely sustainable solution, these coatings must be recyclable at end-of-life; and ideally approved for direct food contact, where meat or poultry present the greatest challenge. The fact that most single-use plastics legislation is targeting take-away food trays in their first round is making these an initial point of entry. For these imparting suitable resistance to hot, greasy, and fatty food is the priority; but prolonging shelf life is not.

Summary of the main financial and fiscal initiatives in the EU that affect packaging



Source: Smithers



FLEXIBLE AND BARRIER PAPERS

Flexible pouches, sachets, flow wraps, and composite films are among the most difficult plastics to recover. They are lightweight and carry a high ink loading, which makes collection uneconomic and produces a lower quality recycle. Furthermore, around half of all flexible packs sold in Europe employ multilayer or laminate constructions, which require different polymer types and foil to be separated before treatment.

One of the hottest areas of innovation in the past two years has been the development of barrier papers to fully replace plastics in formats like pouches and sachets. In 2022, Europe consumed a total of 4.77 million tones of flexible paper packaging – with a value of \$9.69 billion.

Most major specialty paper producers are looking to expand their existing portfolios to offer more recyclable alternatives to plastics; though there are multiple challenges, including appearance, shelf life and resistance to grease or moisture when used with foodstuffs.

Barrier coatings are necessary here too for many applications, in particular recyclable coatings. For this reason, most of the initial market introductions are for dry, less fatty foods, such as confectionary, dry pet food, coffee, or savoury snacks. These have already been adopted by Nestlé, which transitioned all packaging for its Smarties confectionary line to fibre-based packs in Q1 2021.

Converters are looking for drop-in replacements with paper formats that can be used on existing vertical or horizontal fill lines without a reduction in speed. This requires refinements of paper qualities, to enable quick, effective heat sealing. Several paper makers have refined their products to meet this, including UPM's Confidio line of barrier papers, Mondi's AegisPaper range, and Proseal from Drewsen Paper.

Billerud has developed a paper-based flow wrap paper in collaboration with Syntegon Technology. Several major confectionary brands have shown an interest in this – with both Mars and Nestlé announcing market trials in Q1 2023.

Other new formats continue to emerge, including for frozen foods. Parkside Flexibles has produced recyclable paper pouches for frozen seafood that are heat-sealable and carry a water-based coating to give grease and oil resistance. This had its first use in H2 2022, with UK supermarket Iceland.

MOULDED FIBRE

One area where Europe is leading in innovation is in moulded fibre. In 2022, demand for moulded fibre packaging globally reached a value of \$13.28 billion, and Smithers forecasts it will have the fastest annual growth rate for any fibre packaging type.

A material once confined to protective transit packaging and egg cartons is now expanding into trays and formats for an array of other goods. Its main advantage is that as a moulding technology it can copy the complex shapes used in many rigid plastic formats. R&D funds are now being committed to upgrade the quality and speed of pulp moulding lines, to allow them to challenge rigid plastics at commercial scale.

For example, Nestlé’s Nespresso subsidiary now has a fully compostable coffee pod made from moulded fibre produced by Huhtamaki using its new high-precision fibre moulding technology. These are 82% paper pulp and include a waterproof compostable biopolymer film on the interior to ensure the pod does not decompose during brewing. The pulp Nespresso pods will begin sales in 2023, initially on a trial basis in France and Switzerland.

In Sweden Blue Ocean Closures has now begun producing moulded fibre caps, including the fine threading needed to screw these onto a bottle. Another important innovation from Sweden is a dry forming fibre moulding technology developed by Pulpac. Now available under licence, this process uses ‘significantly less energy and is up to 10 times faster’ than conventional wet pulp moulding platforms, according to Pulpac.

Many initial new uses for moulded fibre are in food contact, including food-service channels; as well tops for take-away hot beverage cups. In these applications barrier coatings are still necessary; one interesting development is Stora Enso’s Protēan technology, which is intended for use with moulded pulp food bowls for use with fresh produce, such as salads. With Protēan the barrier material is integrated into the pulp formula, embedding water and grease-resistance into the fibre matrix itself. The material can still be recycled via standard paperboard recycling chains the company says.

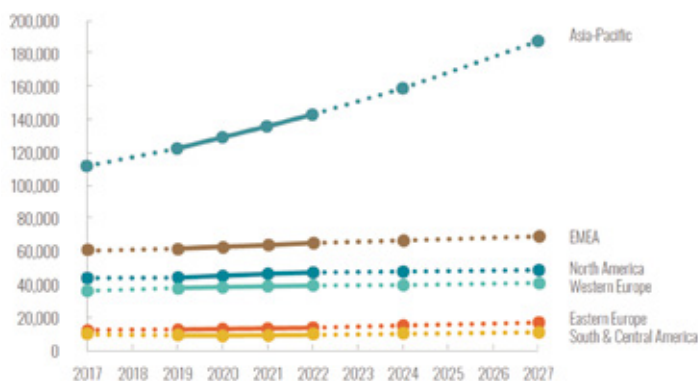
Kraft-Heinz is also keen to move over to more moulded fibre containers, including those suitable for heating in a microwave or and conventional oven. It has worked with Sonoco to introduce a dual-ovenable moulded fibre tray – named Natrellis – based on US-grown sugarcane for its Primal Kitchen premium healthy ready meals. In January 2021 it also began sales of its iconic Mac & Cheese (Kraft Dinner) in a microwave-safe moulded fibre cup, in North America.

LIQUID PAPERBOARD

Fibre formats have only a limited share of beverage markets, where these are present it is almost exclusively aseptic drinks cartons. The liquid paperboard used to make these is problematic, however. The presence of aluminium and plastic layers that give the requisite barrier protection make the paper fibres very difficult to separate at end-of-life.

Europe has pioneered the development of liquid paperboard, and it is more common here than in many other markets.

Global fibre-based packaging market volume by region, 2017–27 ('000 tonnes)



Source: Smithers

The Alliance for Beverage Cartons and the Environment (ACE) notes the 75% of milk and 59% of fruit juice in the EU are sold in aseptic cartons. In 2022 across Europe a total of 2.50 million tonnes of liquid paperboard, with a value of \$12.45 billion, were consumed Smithers data show.

Several of the leading producers of aseptic cartons are looking to redesign packaging to improve recyclability. Elopak, SIG Combibloc, TetraPak have all conducted trials of new constructions without the aluminium layers in Europe. These instead rely purely on PE barrier layers, that are easier to separate in mixed recycling schemes. Innovation is also happening with easier to recycle plastic closures, and tethered caps to align with the requirements for the Single-use Plastics Directive. Tetra-Pak is even using a cutting-edge physics research equipment – the X-ray cyclotron at Sweden’s MAX IV Laboratory – to investigate optimising the moisture resistance of the paper fibres themselves.

Even where a redesign strategy is successful in giving requisite barrier performance in a more recyclable format these cartons will still need to be treated separately at end-of-life. Pilot-scale recovery schemes have been established by manufacturers, but these will only ever collect a small percentage of total waste arising. Consequently, the ACE is calling for an increase in the mandated collection rate in Europe – up to 90% per annum – to create a reliable waste flow and incentivise material in what remains one of the smallest sectors of paper packaging.

Many of the hottest innovations in paper packaging technology will be examined on 4-6 September at Smithers Paper Week Vienna 2023. Co-locating three industry-leading Smithers events in a single location, this will give an unparalleled forum for discussion and networking across the paper value chain. For more information please visit the Smithers website at: <https://www.prima-paper.com/home/smithers-paper-week-2023>

BIO NOTE

John Nelson
(Editor, Smithers)



John Nelson is an award-winning editor and journalist working in the market reports and consultancy business of Smithers. Here he covers market and technology developments across multiple technical and commercial segments; including paper, packaging, sustainability, printing, nonwovens, rubber and tires.



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Interview of Erik Kolehmainen, Vice President Corporate Venturing at Metsä Spring

Metsä Spring, the corporate venture capital arm of Metsä Group, the well-known Finnish forest industry group, is leading the charge in the alternative use of innovative bio-based fibers. We all know that cellulose is a versatile raw material whose potential is not yet fully exploited. In this interview, we speak with Erik Kolehmainen, VP Corporate Venturing at Metsä Spring, about their current investments, the challenges and opportunities of this expanding market, and the potential impact on the industry.

1. Metsä Spring is a subsidiary of Metsä Group. When was it founded and what is its purpose?

ERIK KOLEHMAINEN: Metsä Spring was established in May 2018 by the parent company of Metsä Group, Metsäliitto Cooperative. Metsä Spring's purpose is to seek and advance new business ideas that further develop the forest-based business ecosystem around Metsä Group. To achieve this, Metsä Spring provides financing as well as expertise, both to external startup companies and to own pilot/demo projects (a.k.a. internal startups). The common goal here is to help the startups (external and internal) to pass successfully through the challenging demonstration phase and reach a so-called 'proof-of-concept'. In 2021, Metsä Spring's role was further expanded by establishing the 'Group R&D' function, with the aim to support and invigorate the R&D activities of Metsä Group's existing business areas.

2. You now have 7 participations in your portfolio. What is the total amount invested so far and how is it funded?

EK: Our portfolio currently includes investments in two demonstration projects (a.k.a. internal startups) and four external startup companies. The four external startup investments (Woodio, Montinutra, Innomost and Fiberwood) have in common that their production is based on side streams from Metsä Group's commercial production units. The other two investments are Metsä Spring's own projects, related to novel textile fibres called Kuura and 3D packaging products called Muoto.

We have not published the exact amount of our total investments made thus far, but it is in the range of a couple of tens of millions of euros. The majority of our investments have been made towards our own demo projects, while the external startup investments currently form a smaller portion of the total allocation. In addition, Metsä Group has also launched an extensive R&D collaboration (in total over 100 million euros over four years) jointly with another Finnish company, Fortum and Business Finland, a governmental R&D financier. This collaboration is called ExpandFibre (see expandfibre.com) and it strives to develop new bioproducts from wood and straw. Metsä Spring is coordinating ExpandFibre on behalf of Metsä Group.

3. Which ventures do you see as the most successful and promising?

EK: Metsä Spring's portfolio companies and projects are all still in the piloting and demonstration phases. Therefore, further work is required before it can be identified which projects will be the most successful ones in the end. However, it can be mentioned that our portfolio companies and projects benefit from the continuously increasing demand for bio-based products that replace similar fossil-based products and have gained good initial traction and interest from the market, regardless of the still limited production capacities in the pilot and demo plant scales. We see that the demand for bio-based products remains strong and will further grow in the future, as brands and end customers are paying more attention to the overall sustainability of many everyday products. In terms of investment size, Metsä Spring's largest investment has been made towards the Kuura textile fibre project, which provides a sustainable alternative to fossil-based textile fibres as well as to cotton.

4. Is Metsä taking advantage of the processes and products developed by those start-ups?

EK: Yes, by collaborating and investing in startups, Metsä Group can receive concrete benefits through the startups developing and processing Metsä Group's main products or side streams into higher-value products. For example, Metsä Spring's Kuura textile fibre project focuses on a new sustainable high-value application for paper-grade pulp, and our other internal project Muoto, focuses on pulp-based packaging products, which replace the use of fossil plastics.

The startups in our portfolio help Metsä Group to further improve the efficient use of wood by utilising Metsä Group's side-streams as a raw material in their production processes. These circular economy concepts allow the creation of high-value products from woody side-streams, which would normally be utilised for lower-value purposes in bioenergy production.



One example of this type of collaboration is our portfolio company Montinutra, which extracts valuable biochemicals from sawdust and is currently planning to build a production plant next to one of our sawmills.

5. What does it take to catch the interest of your investment committee?

EK: At Metsä Spring, the investment decisions are made by Metsä Spring's Board of Directors. When assessing potential startups, Metsä Spring looks for the same factors as investors generally do: background of the team, uniqueness of the technology (incl. Intellectual property rights situation), market size, initial market traction, and scalability of the business model. However, as a strategic investor, a very important factor for us is to evaluate how the startup can benefit from operating as a part of Metsä Group's industrial ecosystem. Our primary goal is thus not to invest only based on the economic outlook of the startups, but also to look for opportunities where Metsä Group can provide real business value for the startups. Such examples are providing know-how regarding planning and building pilot and demo plants, selecting the most suitable raw materials, securing sufficient raw material supply, and providing locations and integration opportunities linked to our industrial production plants.

6. How many projects do you study every year, and how many do you decide to endorse eventually?

EK: Metsä Spring is very selective in choosing the projects it will advance. We have gone through thousands of startups and have already come across more than 600 potential wood-based business ideas, six of which Metsä Spring has since invested in. As a strategic investor, it is important for Metsä Spring that the projects are not only good investments from a financial point of view but that the link to the business ecosystem around Metsä Group is strong. Looking at the statistics, in a year, we go through a very large number of opportuni-

ties and identify over 100 wood-based business ideas. Out of these we eventually invest in perhaps one or two.

7. How long do you stay onboard before a possible sell off?

EK: Metsä Spring typically invests in startups that are aiming to build either a pilot or demonstration plant. These are the phases where the projects' true feasibility can be shown (or alternatively, the outcome is the opposite). The time that Metsä Spring stays on board depends on the maturity level of the startup company when the first investment is made. If the company is at an earlier stage and about to build its first pilot plant, the holding period can be longer. This is due to the reason that Metsä Spring has the possibility to also finance the next phase related to the demonstration. The aim of Metsä Spring is to help the companies reach a so-called 'proof-of-concept', where the scalability of the production technology, as well as market demand for the products, has been proven. Once this is achieved, Metsä Spring's mission has been accomplished, as the companies are then able to obtain financing more easily, for example, through bank loans and other instruments. At that point, the startups also become interesting to later-stage investors, potential acquirers or Metsä Group's business areas.

8. What is the project you are the proudest of having supported?

EK: It is difficult to select just one specific startup or project from our portfolio, as our projects are quite different and benefit the development of Metsä Group in different ways. As mentioned earlier, Kuura textile fibre and Muoto packaging products, for example, provide a way to create higher-value products from the pulp that Metsä Group produces. The external startups in our portfolio, on the other hand, are developing solutions which can help Metsä Group to use wood that is harvested in the most efficient and sustainable way. This is done by capturing more value from Metsä Group's woody side-streams.

9. Are you open to evaluate projects from outside Northern Europe?

EK: Yes, Metsä Spring is able to invest in new projects worldwide. However, as Metsä Spring is a strategic investor, an important factor for us is how the startup can integrate into Metsä Group's business ecosystem (we must identify a link). Metsä Group is focused on processing wood from Nordic forests into high-value products. Therefore, solutions that cannot utilize Nordic wood species and are, for example, based on using bamboo as the main raw material fall automatically outside our scope. This creates one practical geographical limitation.

As Metsä Group can provide concrete help and support to the startup companies and in some cases also offer co-location and integration opportunities to Metsä Group's mill sites, geographical proximity does have some advantages.

10. Can you give us a hint of the upcoming investments to be announced?

EK: We have some interesting opportunities in the pipeline regarding further valorisation of pulp as well as side-streams. We are happy to tell you more when new investments have been made.



5 questions to David Buchanan, Regional President Voith Paper North America

Less is more. By using fewer fibres, reducing energy consumption, and minimizing water usage, we can achieve a higher quality and more sustainable paper product. David Buchanan, the President of Voith Paper for North America, explains how their latest technological advancements are contributing to this goal.

1. How does Voith Paper contribute to promoting sustainable paper production through its «Papermaking for Life» program?

DAVID BUCHANAN: Through our «Papermaking for Life» program, we aim to set new standards in sustainable paper production by investing in research and development of energy-optimized products, digital solutions and the efficient use of renewable energies. We also offer comprehensive consulting services to our customers to support them in their journey towards sustainable paper production. Our goals are to achieve 100% carbon-neutral paper production, reduce freshwater consumption by 90%, and increase paper recycling rates to 90% by 2030. We believe that integrating sustainable solutions into a company's operations is important for the environment and society as a whole, ensuring long-term success for all.

2. What are the biggest challenges and opportunities for the paper industry in terms of sustainability and digitalization in the future, and how can companies balance the benefits of technology with the necessity of sustainability?

DB: The biggest challenge for the paper industry is reducing environmental impact while maintaining profitability. Companies must find a balance between the benefits of technology and sustainability by investing in solutions that are environmentally friendly, energy-efficient and promote sustainable production processes. Digitalization offers the opportunity to optimize production processes, reduce costs and improve product quality through the use of predictive analytics, automation and data analysis, while also helping to reduce environmental impact. However, the topic of sustainability extends much further; for example, we recently launched the AiroGuideTune Green roll cover, made with natural materials and certified according to the internationally recognized DIN CERTCO for bio-based products. It is the first certified bio-based guide roll cover for sustainable paper production on the market.

3. That sounds exciting. Let's delve deeper into the topic of digitalization and automation – how has Voith Paper achieved success through in paper production here?

DB: Voith Paper has been a pioneer and innovator in digitalization and automation with its Papermaking 4.0 portfolio, which has been installed in more than 300 locations worldwide. By collecting and analyzing data through its IIoT platform dataPARC cloud, Voith's digital solutions optimize the production process for efficiency, sustainability and quality. This leads to long-term efficiency gains and more sustainable production. The system uses virtual sensors and predictive control to reduce the amount of starch used

while maintaining quality standards. Voith's commitment to sustainability and digital innovation continues to drive success in paper production.

4. There is another lighthouse project in Green Bay, Wisconsin. As the full-line supplier for the Green Bay Packaging PM 4, can you explain how the operation of the plant promotes sustainability?

DB: Green Bay Packaging and Voith are long-term partners, with Voith demonstrating its extensive capabilities and technological expertise in several projects. The BlueLine stock preparation system and XcelLine paper machine laid the foundation for PM 4 to achieve environmentally friendly paper production. The BlueLine OCC stock preparation system features high energy efficiency and is equipped with innovative technologies that minimize fiber loss and ensure high fiber quality even when using mixed recycled paper. In addition, Green Bay Packaging also relies on innovative automation and digitalization applications from our Papermaking 4.0 portfolio to further increase resource efficiency.

5. You have mentioned solutions for saving energy and fibers. What technologies are used in Green Bay Packaging mill to reduce water consumption in paper production?

DB: Next Green Bay Packaging has installed the Voith AquaLine Flex system, which treats and recycles process water to reduce water consumption and minimize environmental impact. The system is equipped with a «biological kidney» that recycles process water, making it reusable in the production process. These systems help the mill achieve minimal wastewater production and a low carbon footprint. The paper manufacturer has been continuously optimizing its water management for 30 years now. Recently, Green Bay Packaging announced that by combining all of its processes, it saves over 4.6 billion gallons of water annually, the equivalent of nearly 9,000 Olympic-sized swimming pools per year - a truly impressive figure!



In Wisconsin, Green Bay Packaging and Voith have built one of the most modern packaging paper mills in the world. From left to right: David Buchanan (Regional President North America, Voith Paper) and Will Kress (President and CEO, Green Bay Packaging).

Life Cycle Assessment (LCA) of Fibres

Article by *Metsä Fibre*

The pulp and paper industry is a significant contributor to global greenhouse gas emissions and environmental degradation. To address these challenges, there is a growing interest in developing sustainable production processes and materials in the industry. Life cycle assessment (LCA) is a valuable tool for evaluating the environmental impact of different production processes and identifying opportunities for improvement. In this article, we will explore the findings of a recent LCA study that evaluated the environmental impact of different pulp production processes, including the Elemental Chlorine Free (ECF) pulp production of Äänekoski bioproduct mill, the pulp production of average European Total Chlorine Free (TCF) pulp mill, as well as the pulp production of average EFC pulp mills in Europe and Latin America.

THE BIOPRODUCT MILL ÄÄNEKOSKI COMPARED TO AVERAGE EUROPEAN AND LATIN AMERICA PULP MILLS

A report commissioned by METSÄ FIBRE OY, on March 23, 2022, and conducted by Fraunhofer IMWS according to the requirements of the International Standard DIN EN ISO 14044, has revealed important conclusions about LCA in pulp production.

The report, issued on October 5, 2022, aims reducing the environmental impact of pulp production and encouraging other pulp industry sites to adapt more sustainable practices. For this purpose, it's intended to evaluate modern pulping technology compared to existing average pulp mills, with the objective of providing insights into pulping technology development. Goal is a comparative assessments of total chlorine-free (TCF) and elemental chlorine-free (ECF) pulp bleaching methods and providing of insights into environmental impacts of pulp production at the bioproduct mill Äänekoski, which started its operation in 2018.

METHODOLOGY

The study used a cradle-to-gate LCA approach to evaluate the environmental impact of the different pulp production processes. The environmental impact categories considered in the study included global warming potential, acidification potential, eutrophication potential, ozone depletion potential, and photochemical ozone creation potential. The functional unit used in the study was one tonne of bleached hardwood kraft pulp produced.

The study analyzes and compares the environmental impact of both ECF and TCF bleaching methods which is an important aspect to consider that ECF bleaching is often viewed as more harmful than TCF bleaching in public discussion. For this purpose, it compares the impacts of sulphate kraft pulp production in bioproduct mill Äänekoski, which uses the ECF process and optimally configured best available technology (BAT), with average pulp mills in Europe and Latin America. The study considered a range of inputs and outputs in the pulp

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Kadant Lamort SAS
39, rue de la Fontaine Ludot,
C.S. 30046
Vitry-le-Francois cedex, 51302
+33-(0)-3-26-74-80-80

Website:
<https://lnkd.in/eBfqkbwq>
Email:
Kadant.lamort@kadant.com



production process, including the use of raw materials, energy consumption, emissions to air, water, and soil, and waste generation. The study also considered the transportation of raw materials and finished products.

The LCA also includes an advanced method for estimating the biodiversity increment of wood feedstocks and independent laboratory tests to support the interpretation of

the assessment made. The additional toxicity tests with luminescence bacteria were carried out to evaluate if impurities, such as AOX, have an impact on toxicity.

In addition to the bleaching sequence, the study has also investigated the highly efficient subsystems of the bioproduct mill Äänekoski in comparison to average pulp mills. The studied subsystems include a highly efficient heat recovery boiler, highly efficient ECF bleaching (resulting in higher yield with less fibre loss), and highly efficient recycling of chemicals. The scope of the study has also encompassed the assessment of the use of raw materials from forest systems, with a particular focus on northern European and Latin American forests.

It's worth noting that the composition of hardwood and softwood in Äänekoski bioproduct mill to an average Europe EFC pulp mill was considered in the production methods in equal mass ratios, while only an average Latin America EFC pulp mill contains 100 weight % hardwood from one species, eucalyptus. This is because the Latin America-based pulp mills use no mixed ratios of wood type in feedstock.

IMPACT CATEGORIES

In this study, different impact categories have been selected for the environmental assessment based on the European Union Environmental Footprint methods. These categories include Climate Change, Ozone Depletion Potential, Particulate Matter, Acidification, Eutrophication, Land Use, Emissions of Ionising radiation and Water Use. The impact indicators are described in associated characterization models, and their robustness is classified into three factors. Robustness I means the most reliable ana-

lysis, while Robustness II and Robustness III indicate the need for improvement and results to be used cautiously, respectively. The actual state of science and the high sensitivity and complexity of matter have been taken into account for the selection of these impact categories. The up-to-date environmental footprint Version 3.0 is used in this assessment.

FINDINGS

The results of the study show that the Äänekoski bioproduct mill has a lower environmental impact than the average European TCF pulp mills and the average pulp mills in Europe and Latin America in most of the analyzed categories. The bioproduct mill showed lower global warming potential (GWP), acidification potential, and eutrophication potential than the other types of mills. The bioproduct mill also showed higher renewable energy production and lower use of fossil fuels than the other types of mills, indicating its potential as a sustainable alternative to traditional pulp mills. However, the production and transport of chemicals still significantly contribute to the mill's GWP impact. The forest system used as feedstock for Äänekoski bioproduct mill contributes to Ozone Depletion Potential (ODP) as a hot spot, which is not the case for other average technology pulp mills.

The study found that the use of ECF technology in the bioproduct mill significantly reduced the environmental impact of the pulp production process. ECF technology uses chlorine dioxide as a bleaching agent, which results in lower emissions of dioxins and other harmful substances compared to traditional bleaching processes that use elemental chlorine. The study also found that the bioproduct mill's use of renewable energy sources, such as biomass and black liquor, further reduced its environmental impact.

In terms of human health impacts, the mill operation of the bioproduct mill has low emissions of Particulate Matter (PM) compared to average ECF and TCF mills, but the used chemicals significantly contribute to the impact of Ionising radiation. The impact on human toxicity is not significantly different from the average ECF and TCF mills.

Regarding land use, the bioproduct mill requires a larger area of forest due to the use of wood from thinning out, resulting in a higher Soil Quality Index compared to ECF pulp production on the European average and all other models. The biodiversity indicator for the feedstock used in the bioproduct mill is sufficiently accurate, but further scientific investigations are needed to reflect aspects of changes in land use. The average Latin American ECF pulp production has a lower Soil Quality Index due to short crop rotation in eucalyptus cultivation.

The study also highlighted the importance of considering the entire life cycle of a product when evaluating its environmental impact. For example,



the study found that the transportation of wood chips to the pulp mill had a significant impact on the environmental performance of the Äänekoski bioproduct mill. The study suggests that optimizing transportation routes and using low-emission transportation modes can further improve the environmental performance of the bioproduct mill.

The study also found regional differences in the environmental impact of pulp mills. The European and Latin American pulp mills in the study had higher global warming potentials than the bioproduct mill, indicating the need for region-specific assessments to identify the most effective solutions for reducing environmental impact.

IMPLICATIONS

The study's findings have important implications for the pulp and paper industry and for policymakers and regulators. The adoption of ECF technology and the use of renewable energy sources in pulp production can significantly reduce the industry's environmental impact while also improving energy efficiency and promoting the use of renewable energy sources. The results of the study can inform decision-making in the pulp and paper industry and contribute to more sustainable practices.

The study's findings can also inform policies and regulations aimed at reducing the environmental impact of the pulp and paper industry. LCA can be a useful tool for setting environmental standards and identifying opportunities for improvement in the industry. Governments and regulatory bodies can use the study's findings to develop policies that incentivize the adoption of sustainable production practices and technologies in the industry.

The study's findings also have implications for consumers and businesses that use paper and paper-based products. The environmental impact of a product is not just determined by its production process but also by its use and disposal. Consumers and businesses can reduce their environmental impact by using paper products efficiently, recycling, and opting for products made from sustainable materials.

RECOMMENDATIONS

Based on the results of the study, it is recommended that the client continue to strengthen cooperation with suppliers of essential chemicals to gain further insight into the environmental impacts of chemical production and transport. Approaches for further reduction of environmental impacts include optimising the energy mix for the production of the necessary chemicals or expanding the recovery or on-site production of required chemicals, using the energy from renewable sources available at bioproduct mill Äänekoski. Constructive cooperation with the forestry sector should also be further developed and recommended in paper industry bodies for further dissemination.

Efficient design and operation of high temperature heat recovery boilers and chemical recovery systems should also be recommended for further dissemination in paper industry bodies. Communication to end-users should follow the resource-efficient paper approach, proactively pointing out that forestry is available but not infinite.

For stakeholders and the interested public, it is recommended that the advantages of virgin fibre pulp from the Äänekoski bioproduct mill be highlighted without concealing disadvantages or pointing out further optimisation potential, such as the (environmentally) conscious use of renewable raw materials.

Finally, the successful operation of the Äänekoski bioproduct mill has set a good example for the use of efficient systems for the recovery of processing chemicals and process energy, which should be taken into account for further planning of production sites.

ADDITIONAL INFORMATION

The Äänekoski bioproduct mill in Finland has the highest levels of energy, material, and environmental efficiency in the world. Its modernization to a bioproduct mill has tripled its production capacity compared to the previous pulp mill, and it operates within the environmental permit and wastewater permit conditions of the previous mill. An advanced closed cycle in which water and chemicals are recycled and returned to the process for reuse is key to the bioproduct mill's processes. Chemical analyses of the wastewater from the bioproduct mill show that the values are below the Best Available Technologies (BAT)-associated emission levels for bleached kraft pulp mills. The Äänekoski bioproduct mill has emissions that do not affect the recreational or other use of the natural water system. In studies carried out, modern pulp mills using elemental chlorine-free (ECF) bleaching, with wastewater being treated in an active sludge plant, do not cause harmful emissions of organochlorine compounds into watercourses. Overall, total wastewater toxicity in modern mills is very low, and reducing the AOX content of wastewater from 0.5 kg per tonne does not bring demonstrable environmental benefits.

CONCLUSION

In conclusion, the life cycle assessment of pulp production processes provides valuable insights into the environmental impact of different production methods. The study found that the Äänekoski bioproduct mill's ECF technology and use of renewable energy sources resulted in a lower environmental impact than traditional pulp mills. The study's findings can inform decision-making in the pulp and paper industry and contribute to more sustainable practices. The study highlights the importance of considering the entire life cycle of a product when evaluating its environmental impact and the need for region-specific assessments to identify the most effective solutions for reducing environmental impact. Ultimately, the study contributes to the development of a more sustainable and responsible pulp and paper industry.





A global initiative to profile the sustainability of conventional and alternative fibers

Article by *Ramon E. Vera, Naycari Forfora, Ryen Frazier, Keren A. Vivas, Ivana Azuaje, Alonzo Pifano, Fernando Urdaneta, Jorge Franco, Amelys Brito, Isabel Urdaneta, Rhonald Ortega, Mariana Lendewig, Stephanie Gongora, and Ronalds Gonzalez, SAFI*

Passionate researchers at North Carolina State University are spearheading a global initiative to evaluate the sustainability of conventional and alternative fibers. This unique research program, conducted in collaboration with 25 industry players and NGOs, promises valuable insights for the entire value chain.

SAFI (the Sustainable and Alternative Fibers Initiative) is a global initiative focused on advancing knowledge and technology for evaluating the sustainability of conventional and alternative fibers. Led by Prof. Ronalds Gonzalez at North Carolina State University, SAFI has attracted support from over 25 companies and three global non-profit foundations. In addition to assessing the sustainability of fibers, SAFI is examining both technical and socioeconomic aspects to determine how comparable non-wood fibers are to conventional fibers for producing bio-based products such as tissue paper, packaging, textiles, and nonwoven substrates. This collaborative effort between academia and industry aims to develop data that aligns with market trends. The programme employs 18 Ph.D. students, providing them with valuable career development opportunities while offering consortium industrial members access to highly skilled and motivated professionals. The initiative takes a holistic and integrated research approach that encompasses seven areas: feedstock supply chain, characterization, conversion (pulping), fiber and product performance, techno-economic analysis, life cycle assessment, and consumer perception.

GLOBAL RESEARCH MATCHING GLOBAL MEGATRENDS

The increased interest in using alternative non-wood fibers such as wheat straw, miscanthus, switchgrass, sorghum, bamboo, and agro-industrial residues for manufacturing paper products is playing a decisive role in the future of fiber-based products. Nowadays, alternative fibers have an emerging op-





portunity to be incorporated into industrial processes, and their utilization is not limited to packaging or printing paper. It is also being evaluated for producing valuable products such as hygiene tissue and textile fibers. A representative example belongs to the hygiene tissue market seeing an increase in the offering with products containing alternative fibers. Besides bamboo, it is possible to observe that several companies have started to incorporate wheat straw, Miscanthus, and switchgrass fibers in their tissue products. Essity is the most prominent reference leading the European market with premium tissue products containing wheat straw fibers.

Global megatrends are leading the irreversible trend toward more sustainable products where sustainable fibers have started to play a significant role. SAFI consortium has been able to develop the largest global research effort toward these global megatrends where sustainability, e-commerce, changes in social behavior, and generational changes are some of the global shaping forces dominating consumer and market behavior. Sustainability is core at SAFI. Unique and trustful Life Cycle Assessment (LCA) methodologies are developed and used to quantify carbon footprint associated with the production of the biomasses, their conversion to fibers, and their use in multiple products. Moreover, SAFI is developing solid and ground-breaking methodologies for sustainable conversion processes of alternative fibers.

E-commerce is an important megatrend that SAFI has been able to match significantly ahead of the current market. The digitalization trend and the consequences of the COVID-19 pandemic-related lockdowns plummeted the demand for printing paper, an important recycled feedstock in the tissue paper industry. Part SAFI's early research project was based on upgrading and utilizing old corrugated carton (OCC) as alternative source for hygiene tissue production. OCC has already begun to be used for several hygiene tissue companies and products are now found on the shelf.

Consumer perception is an important research area in SAFI consortium. This effort is focused on understanding what are the drivers and demands of consumers looking for sustainable products, especially containing alternative fibers. SAFI is researching what attributes and information consumers need to recognize a



product as sustainable and how the purchasing behavior changes based on demographic criteria. CO₂ emissions of the product is one of those attributes' consumers are and will be demanding. New and future generations are eager for sustainable products while being able to pay premium prices for products containing more sustainable attributes.

Alternative fibers also are promising for mitigating the huge environmental impact of the textile industry, especially related to the vast use of synthetic and nonbiodegradable fibers. SAFI consortium is also exploring opportunities to produce textile fibers from non-wood feedstock. The successful implementation of alternative sources to produce fibers that match the quality and performance of conventional textile fibers is a worldwide need for a more sustainable textile industry, which can already be observed in the current textile market. Moreover, SAFI is making efforts to upcycle textile wastes and mitigate the dramatic textile landfilling and burning.



TECHNICAL AND ECONOMICAL ASSESSMENTS

Supply chain assessment: The team assesses feedstock supply chain to identify the availability of raw materials for a given location. The main objective is finding locations suitable to supply and meet the demand of specific feedstocks. To do so, the team not only relies on reported data but also has visits sites worldwide, directly talking to producers, suppliers, and consumers to understand the supply risks associated with the feedstocks of interest. In cases when the availability is not enough to satisfy demand, the cost of a new plantation is also included in the analysis.

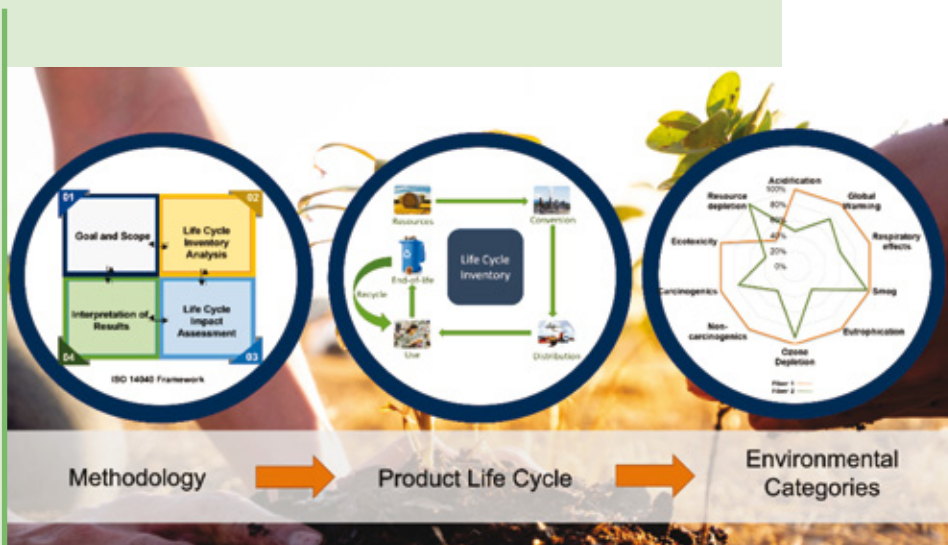
Technical feasibility: Suitable and easy-to-implement conversion processes to obtain the alternative fibers are implemented by the consortium. A particular scenario is the implementation of circular pulping processes where value-added byproducts are obtained. As a result, economic viability of the fiber conversion process is improved while implementing circular economy and integrating the pulp & paper industry with other industries such as the agroindustry. Once the fibers are obtained, their performance is evaluated and compared to conventional fibers to identify potential applications. A particular finding is the ability of the non-wood fibers to either match or improve the performance of benchmark fibers while using less quantity of fibers. SAFI has state-of-the-art equipment and facility and perform all lab and pilot trials at NC State University.

Techno-economics: By gathering all the supply chain and conversion data, the techno-economics analysis is developed by simulating industrial-scale pulping processes. Both mass and energy balances are used to estimate the cost of several conversion scenarios. The team has been able to provide data that speaks of possible cost reduction using non-wood fibers under specific conditions. So far, SAFI has evaluated the feasibility of constructing greenfield and colocated mechanical pulp mills using non-wood fiber feedstock.



SUSTAINABILITY ASSESSMENT

Sustainability is a major topic for producers, consumers, and policymakers. SAFI uses life cycle analysis to quantify the environmental impact of both conventional and alternative fibers. However, besides simulating, SAFI is looking for reliable methodologies for sustainability metrics. An example relies on the sustainability of recycled fibers where more than fourteen allocation methods are used in the industry to perform LCAs. However, the objective in SAFI is to define the most suitable and reliable allocation method to reduce subjectivity and improve data comparability. In addition, LCA creates uncertainty since different methods tend to yield different results that may need to be clarified from the industry’s point of view. To improve transparency, SAFI’s sustainability team is analyzing current methods in order to develop a scientific-based approach that will allow SAFI members to determine assertively their sustainability metrics. LCA methodologies developed in SAFI are expected to be worldwide reference in the industry in the next 5 years.



New opportunities in bioproducts

Article by *Lotta Forssell, VP, Marketing and External Communications, Pulp and Energy, Valmet, and Peter Cura*

The global megatrends, climate change mitigation and the circular economy, are driving key forest industry players towards a major industrial transformation. The industry is moving from traditional business models and bravely embracing new technologies, striving for new value adding products and studies the possibilities of using new raw materials.

The pulp industry has maintained a strong tailwind for a few years now, for many reasons. The steady growth of the global tissue paper market, exacerbated by the tightening supply of recovered paper, and dramatic changes in China's papermaking fiber furnish, have all contributed to the present state of the pulp industry and markets.

Improving safety and environmental efficiency, improving production efficiency, product differentiation and producing new bioproducts are topics the pulp and paper companies increasingly interested in. Utilization of annual fibers as raw material both for pulp and paper production

as well as for bioproducts has emerged again as of interest driven by wood biomass availability and price.

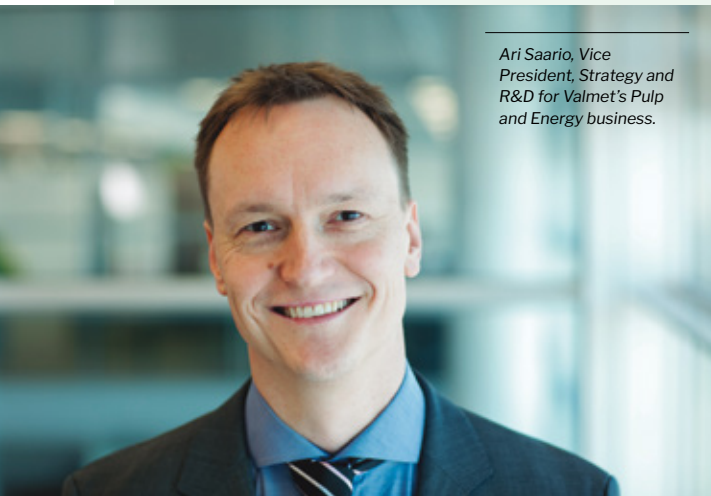
ANNUAL FIBERS AS A POSSIBLE RAW MATERIAL

"Annual fibers such as wheat straw, bamboo and bagasse have been used as raw material for paper making for decades. But the fact is that compared to wood biomass agro biomass has different fiber characteristics. For kraft pulp production there are significant challenges in the recovery process especially due to the high silica content of most annual fibers," **Lari Lammi**, Director, Strategy and R&D for Valmet's Fiber Processing business, explains.

"Despite these challenges, the use of annual fibers in bioproducts is an exciting area of research and development that has the potential to create more sustainable solutions. Annual fibers can be utilized in the production of various bioproducts, like bio-based chemicals, liquid biofuels and even textile fibers," tells **Ari Saario**, Vice President, Strategy and R&D for Valmet's Pulp and Energy business.

"Just like in always when developing and commercializing new technologies working together with different partners across the value chain is important in developing new bioproducts and new raw materials. As an example of partnerships, we are developing our kraft lignin extraction technology together with our customer Stora Enso. In the field of annual fibers, we have collaboration with universities and research institutions as well as with some potential customers who are looking into possibilities in this field," Saario adds.

In the recent years, Valmet has delivered prehydrolysis technology for the production of bioethanol from annual fibers to Praj in India



Ari Saario, Vice President, Strategy and R&D for Valmet's Pulp and Energy business.

and Clariant in Romania. With the prehydrolysis technology biomass is treated at high temperature and pressure and then safely discharged, effectively separating out sugars to be further refined into second-generation bioethanol.

“Our pretreatment concept is developed from our long experience in pulp and fiberboard production. We have further developed it to meet new process requirements for the initial hydrolysis step in second-generation bioethanol production. The Pretreatment BioTrac system can handle essentially all lignocellulosic biomasses, including wood and forest residuals, wheat straw, corn stover and bagasse,” Lammi complements.



Joao Cordeiro, Head of Pulp & Paper, AFRY Process Industries.



New opportunities in the utilization of annual fibers is also a part of Valmet's Beyond Circularity R&D program, which was launched in 2022. The target of the program is to support the green transition in Valmet's customer industries. The focus is to develop process technologies, automation and services for utilizing renewable materials and recycled, waste and side streams and to further improve the energy efficiency of Valmet's process technologies.

AN EXCITING FUTURE FOR BIO-PRODUCTS

Joao Cordeiro, Head of Pulp & Paper, AFRY Process Industries explains, “The global market for novel bio-based products is still relatively small and probably valued at some USD 13-15 billion. The market encompasses a wide range of products, including tall-oil and other wood extract-based products (such as renewable fuels and chemicals); liginosulfonates and emerging novel lignin-based products; basic chemicals such as methanol and sulfuric acid and CMC; Nano- and MFC celluloses; and pyrolysis oils and pellets.

Today, wood-based textile fibers mainly include viscose, lyocell, acetate, modal and cupro fibers, and global consumption is just under 8 million tonnes, with the market itself valued at some USD 15 billion.”

“Although they only represent a small part of the traditional forest business, the markets for novel bio-based products are expected to more than double in value during the next 15-20 years,” Cordeiro says. “This is confirmed by high investment activity of the leading forest industry players. Investments range from pilot plants to semi-commercial and commercial scale operations. By 2035, most modern pulp mills will host multiple complementary businesses and a significant part of their revenues will originate from these products. We will also see many new standalone wood-based facilities, which do not produce conventional pulps or papers, but which will instead focus on the production of bio-based chemicals, novel textile fibers or other innovative bio-based materials and fuels.”

“As the industry diversifies its product and technology portfolio, it is simultaneously improving its environmental credentials and setting the scene for a more sustainable future,” he adds.

ADDITIONAL VALUE FROM PULP MILL SIDE STREAMS

“The utilization of side- and waste-streams will accelerate in the next 15-30 years,” Cordeiro, predicts. “More and more bioproduct technologies are achieving commercial production scalability driven by strong demand from large brand owners and environmentally conscious consumers.”

“Tangible investments in state-of-the-art pulp mills with multiple products are already happening. This brings a clear diversification of portfolio, alongside conventional pulp and green power. Novel products include advanced renewable fuels, bio-based chemicals, lignin-based materials, novel wood-based textile fibers and the emergence of green hydrogen-based “Power-to-X” range of fuels and chemicals,” Cordeiro adds.

TOWARDS CLIMATE-NEUTRAL PULP PRODUCTION

Pulp mills can play a key role in combating climate change because pulp is an intrinsically renewable and recyclable raw material. Modern pulp mills are already today fossil fuel free and there are several ways to reduce emissions also at existing mills. Emissions can be reduced at the mills by replacing fossil fuels with renewable. Improving energy efficiency can reduce mill's own emissions or enable reduction from energy production outside the mill, by producing excess amount of renewable electricity and steam. For example, the Metsä Fibre Äänekoski bioproduct mill in Finland produces 140% more electricity than the mill itself uses.

Cordeiro summarizes the different ways for pulp mills to be climate neutral or even carbon negative: “Energy efficiency in pulp production can be improved by design and by testing new concepts, such as alternative pulp drying technologies. When it comes to switching fuels, many modern pulp mill designs can avoid fossil fuel use completely. Switching fuels is particularly important for lime kilns since they traditionally consume fuel oil or natural gas. The main alternatives include biomass gasification (e.g., of bark and wood residues) and direct wood powder firing. Some companies have tried burning methanol or even tall oil, but typically these fuels find better value in other applications. Lignin separation is a feasible way to avoid fossil carbon emissions. The separated lignin can be used as fuel or raw material for value added products such as battery components or carbon fibers.”

“A third route to reducing emissions is also emerging. This involves capturing CO₂ emissions, particularly from the recovery boilers and lime kilns in kraft pulp mills. E-fuel production is another example of an emerging technology. It utilizes captured carbon dioxide in combination with renewable hydrogen to produce electro-fuels such as sustainable aviation fuels (SAFs) and e-methanol. Pulp mills are excellent platforms for capturing biogenic CO₂, as they can leverage existing renewable power to produce green hydrogen and then combine these two elements into value-added e-fuels. Several pilot and commercial scale investments are already happening,” Cordeiro concludes.



Know your fibers, control your process

L&W Freeness & Fiber Online

Managing pulp mixture quality starts with the reliable and frequent measurements from L&W Freeness and Fiber Online. For mills wanting to learn how best to apply these fiber measurements for deeper analysis and tighter control, ABB is offering customers an exclusive, complimentary copy of the ABB Fiber Guide 2.0. Contact your local account manager or learn more at: abb.com/pulpandpaper.





Efficient Paper Machine Dewatering

Article by *Anna-Riina Ahonen, Runtech Systems*

Efficient dewatering is a critical step in papermaking, as it directly impacts the final product's quality and production cost. In this article, Runtech explores the latest technologies and best practices for optimizing paper machine dewatering through some interesting success stories

Runtech's tailor-made solution, RunDry significantly improves nip dewatering, energy saving and enables increased dryness after the press section. RunDry nip dewatering is a complete solution with the payback time typically under 1 year. It comprises of save-alls, doctoring including blade holders, carbon fiber doctor beams, double doctors and AirBlades, forming and dryer section cleaning systems as well as EcoFlow dewatering measurement system.

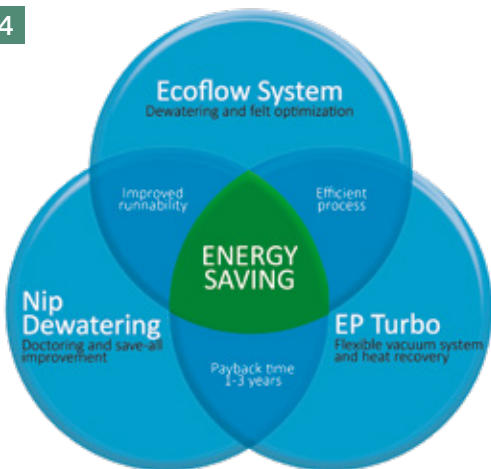
The most efficient and economical method of water removal in the press section is nip dewatering. When upgrading the vacuum system may bring the biggest energy savings, optimized dewatering with doctoring and save-alls provides often very good results with a small investment effort, and is an important step in optimizing the efficiency of the paper machine. Dewatering and doctoring are not only related to energy consumption, but also play a big role in paper machine runnability, efficiency and profitability, as well as paper profiles. The increased dry solids content after the press improves web wet strength, making the web stronger and allowing it to withstand unstable conditions in the drying section. This, in turn, is directly related to dryer section runnability, since good tensile strength reduces web breaks and improves end product quality.

SAVE-ALLS WITH INTEGRATED DOCTORING

Well-designed and built save-alls with integrated doctoring are essential to get the full benefits from increased dewatering and ensure efficient water discharge with perfect rewet prevention. Correctly designed Save-Alls are capable of handling 100% nip dewatering without rewetting. Runtech save-alls are specially designed for AirBlades and EcoFlow dewatering measurement systems. They deliver reliable operation in all press and wire section positions and press section rebuild packages.

The delivery to Smurfit Kappa Hoya PM2 included several doctors and Save-Alls for the press section and a complete EcoFlow dewatering measurement system. Hoya PM2 runs up

4



to 1100 m/min with 90 g/m² basis weight. Width at the press is approx. 8 meters. The mill reported that after the rebuild they have been able to increase the machine speed by 100 m/min with 90 g/m² basis weight. Dryness increase after press section is from 51% to 53,5% and from 54% to 56% with the basis weights of 90 and 220 g/m², respectively. Increased dryness means less picking on the dryers enabling better machine runnability and less sheet breaks.

DOCTORING - THE KEY TO A WELL-PERFORMING PRESS SECTION

A well-designed doctoring system is the key to a well-performing and energy-efficient press section. Optimized doctoring leads to increased dryness after the press section. Savings in dryer section steam usage are notable. Runtech's offering includes CompoAdapt, a hose loaded blade holder providing easy maintenance and trouble-free operation and CompoDoc carbon fiber doctor beams with excellent doctoring performance.

Double doctors provide optimal doctoring for suction couch and press rolls. AirBlades are air assisted doctor blades for the press rolls that enable high nip dewatering even with low machine speeds, help with roll cleanliness problems, improve moisture profiles and have a positive effect on machine speed.

At Papelera de la Alquería, a shoe press RSP AirBlade was installed as a part of the vacuum system rebuild project. The shoe press in question is the last nip before the dryer section where Uhle boxes were used before but there

5



- 1: Save-alls result in higher dryness after press, better moisture profiles, less steam consumption and reduced draw from press to dryer. Save-alls are specially designed for AirBlades and EcoFlow dewatering measurement systems. They deliver reliable operation in all press and wire section positions and press section rebuild packages.
- 2: AirBlades are needed when increased nip dewatering leads rewetting, crushing, wrinkles, etc., there are roll cleanliness problems, uneven moisture profiles, and with soft rolls – a non-contacting option is a must.
- 3: CompoAdapt (#3000)+composite benefits: CompoAdapt Blade Holder is the first full carbon composite tube loaded blade holder. It is easy to maintain and handle, including the blade changes and is trouble-free to operate. Composite construction makes it light and resistant to heat expansion, corrosion and chemicals.
- 4: Holy triangle.
- 5: EcoFlow is the only reliable and accurate online dewatering measurement system for water that contains lot of air. When you measure the water flow accurately, you can adjust the vacuum optimally and reach high energy efficiency.

was no doctor. Runtech delivery included a new backing bar inside the shoe press roll, a doctor with the hose loaded CompoAdapt blade holder and a RSP AirBlade. After the AirBlade installation, the mill is able to run without Uhle boxes. 7% reduction in steam consumption and 11% increase in the average machine speed have been reported.

Another example of a press section doctoring rebuild is a delivery to a kraftliner machine (90 – 400 g/m²), which targeted to energy and steam saving. Project included a new doctoring system for the press suction roll, the 1st press bottom roll, the 3rd press top roll and the 2nd pick

up roll. Magnetic flowmeters were replaced by complete press section EcoFlow system.

Before the rebuild, a total of 10 liquid ring pumps and 8 Uhle boxes were used. Due to the improved doctoring the machine is now able to run with full nip dewatering. Thus, only 2 Uhle boxes are in use, which means stopped pumps, less load for drives and less felt wear. There is no need to wash the felts during the entire felt life time resulting in less shutdowns and chemicals. The paper machine total steam consumption is significantly lower than before.

Now the paper machine operates 5-6 liquid ring pumps depending on the basis weight and speed. 10 GWh annual energy saving and production increase have guaranteed a short pay-back time.

STEADY, RELIABLE AND MORE ECONOMICAL RIDE

Prior to the save-all and doctoring project the production manager of a European fluting & testliner machine explained the reasoning for the rebuild being similar to purchasing a cruise control for the car: "You won't drive faster, but your ride is more steady, reliable and ultimately more economical". The mill gained an average speed increase +10 m/min right from the beginning, and additional +10 m/min later on. Speed increased for all grades, and also top speed increased. One of the liquid ring pumps was switched off right from the beginning and another later. This was not originally planned but as it became possible, mill saves additional 100k€ annually. In addition, the operation is back to normal faster after felt change, e.g. bottom felt on target in 24h as it previously took 3 days and there is no or less felt washing needed.

Delivery included a Save-All with top Catch Pan and two integrated blades for press suction roll, Double Doctor for 1st press bottom roll, splash wall after 1st press bottom roll and a full EcoFlow system for wire and press sections.

The main benefit for the mill is a much more controlled (more precise and faster) operation concerning dewatering and process stability.

EcoFlow gives a good process transparency and allows setting the key parameters for the operators in a new and better way. Trouble operation, like problems with sheet edges, are avoided or solved much quicker than before.

OPTIMIZE VACUUM LEVELS

Combining dewatering improvement with vacuum system rebuild can bring the biggest benefits, especially if the mill is still using conventional vacuum pumps. At Vege PM1 fine paper machine in Turkey Runtech upgraded the vacuum system with a single-stage EP500 Turbo Blower, EcoDrop water separator and EcoFlow Multi dewatering measurement. Delivery included also Combi press save-all with RSE AirBlade and 3rd press bottom roll doctor with RSP AirBlade.

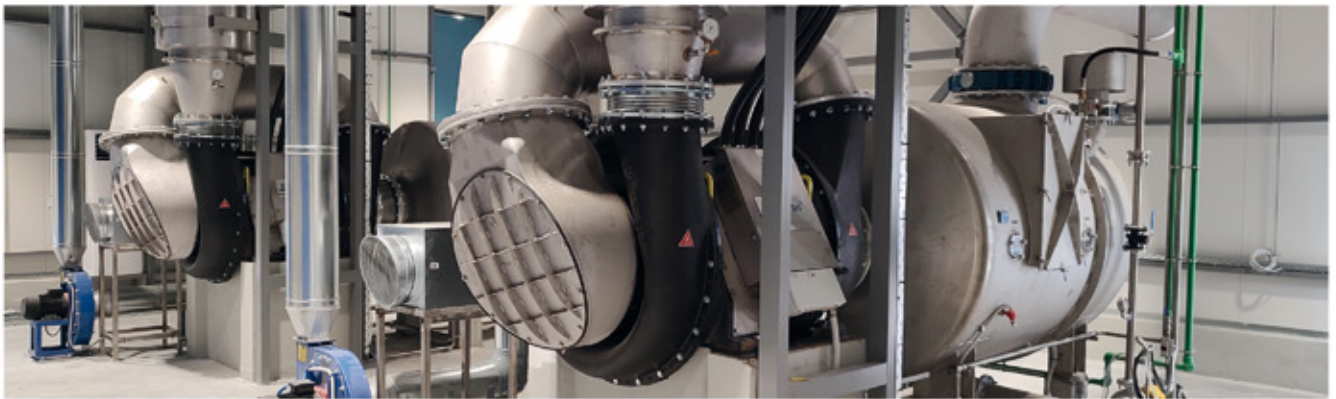
Improvement of the press section dewatering and optimizing the vacuum levels with EcoFlow made it possible for the mill to run only with one EP500 Turbo Blower. Seven liquid ring pumps were stopped, providing energy savings of 700kW and water savings of 60 000 m³ per year. Specific energy consumption decreased from 93 kWh/t to 21 kWh/t. Even with maximum nip dewatering there is minimum rewetting. Specific steam consumption was reduced by 10% and there are less sheet breaks.

PERFECT FIT FOR ALL NEEDS

With the experience of thousands of vacuum system audits and dewatering studies at paper mills, we are able to benchmark the effectiveness of existing vacuum systems, dewatering equipment, suction elements, fabrics and felts. All information comes together in an often step-by-step rebuild or upgrade plan that results in minimized operational expenses coupled with a production increase and/or runnability improvements. Runtech's combined expertise of doctors, save-alls and vacuum system equipment enables us to provide a holistic view for improved paper machine dewatering and energy efficiency. With our solution portfolio, we can always find a perfect fit for our customers' demands, needs and budget.

CLEANLINESS & Dewatering
RUNNABILITY & Tail Threading
AUDITS & Consulting

Maximize the efficiency of your papermaking process



Runtech's RunEco paper machine vacuum system provides a reliable, completely water-free vacuum solution. EP Turbo Blowers always feature variable speed and capacity. An integrated high-speed motor makes the system very compact and easy to install. In most cases, an existing system can be replaced with minimum piping and civil work costs. Most of the installation work can be carried out while the machine is running. In typical rebuild cases, energy savings amount to 40–60% compared to the old system.

950

RunEco EP Turbo Blowers

2.3 TWh/a

amount of energy saved

137 MIO€/a

cost of energy saved

45%

energy saving in average

686,000

tons of CO₂/a reduced

runtech.sales@irco.com
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Technology plus talent: formula for success in modern pulp and paper mills

Article by *William Dannelly, Global Product Line Manager at ABB Pulp and Paper*

Pulp and paper mills that deploy the right combination of digitally enabled quality control systems (QCS), together with traditional physical equipment inspections, can reap the benefits of optimized production, enhanced quality control and reduced downtime

The unexpected events of the last few years, notably the pandemic, have had a profound impact on business practices, accelera-

ting the transition to remote and home working. While industry has adjusted to this new normal, it has highlighted systemic vulnerabilities in global supply chains and underlined the need for industry leaders to reassess how they engage with the digital transition.

Add to that global political instability, and the impact of the war in Ukraine, and you have a perfect storm of challenges facing manufacturers across multiple sectors. This is compounded by the perennial need to optimize production, maintain quality, reduce costly downtime, while at the same time limiting waste, energy usage and environmental emissions.



Adversity does, however, bring with it opportunities to disrupt the existing order by eschewing entrenched, inefficient working processes and taking a simpler, smarter approach to digitalization; an example being the trend for remote project commissioning and servicing during the pandemic.

Adversity also demands that the foundations of any operation are as robust and resilient as possible.

This is particularly true for the pulp and paper industry. The pandemic was a challenging time for operators who had to keep mills running in difficult conditions and were focused on surviving rather than thriving. It's not surprising that, during a time when people were running on empty and under intense pressure, certain disciplines became a lesser priority.

Now is the time to re-instill discipline and bring back some of the good habits that may have been lost during these difficult years. We need to collectively remind ourselves of the importance of the basic, daily hygiene that is so critical to mills: regular service, maintenance, continual optimization, troubleshooting, long-term planning and more.

Let's take the discipline of regular, physical inspection and maintenance as an example; pulp and paper operators cannot afford, nor no longer have an excuse, to let service levels drop.

In this article I will discuss how we can restore best practices and deploy new tools and add-on digital extensions that have become available since the pandemic to ensure optimal performance and maximum availability.

THE LIMITATIONS OF BIG DATA

As someone who works for a technology leader such as ABB, I am, naturally, an advocate for leveraging data and its unique ability to provide greater visualization of an entire manufacturing production chain.

Much has been written about how the industrial internet of things, AI and Big Data are automating industrial processes, resulting in production and cost efficiencies, as well as freeing up workers from performing repetitive tasks in risky or inhospitable environments.

What we have seen during the past few years, however, is that Big Data has its limitations when it comes to driving real business value for large industrial manufacturers. Big Data is about collecting vast amounts of granular information on every facet of plant operations and centralizing it in a single repository where it can be collated, analyzed and then applied

to optimize production and identify potential failures before they occur.

That's fine, but pulp and paper operators are realizing that they don't necessarily need large quantities of historical data, or even have large quantities of sufficient detail, as much as they need solutions that keep pace with the rapidly changing operating environment in their mill. This is why, at ABB, we focus on understanding how those processes work and tailor our data-driven solutions to mill-specific parameters to effectively apply those principles to areas that deliver real value: cost to produce, throughput, availability and quality.

Most importantly, there is a greater appreciation of how those insights can drive business value to the end product. That is perhaps the single biggest change that we at ABB have witnessed over the past five years. Digital can adapt to such requirements quickly and seamlessly and as such, we have responded by focusing our digital offering on each customer's parameters to better understand their specific processes.

THE IMPORTANCE OF PEOPLE POWER

You can have all the technology in the world, but it is only as effective as the talent that goes hand in hand. The workforce remains a critical step on the journey to autonomous operations. In my view not enough has been written about how the digital transition must be supported by the transformation of processes and people.

Pulp and paper is a great example. The sector is traditionally viewed as being risk-averse when it comes to adopting new technologies, but, encouragingly, during the pandemic we saw an increased interest from many mills to embrace new tools and processes such as remote commissioning and maintenance. Now, as we return to more traditional post-Covid ways of working, it's crucial that operators continue to invest their time and expertise so as not to allow service levels to slip.

Let's take the example of a Tesla car to illustrate the point. Tesla gathers a multitude of



data about the car itself and how it is driven, but it is still a mechanical thing. You still have to put air in the tires and wash the windshield or the car will eventually, without upkeep, become undrivable.

During the pandemic you couldn't leave the house, so you weren't putting as many miles on your car, meaning that maybe you weren't servicing it as often as before. This may not cost you anything in the short term, but that doesn't mean it's the right thing to do in terms of servicing and keeping expensive equipment at optimal performance.

Transfer that to a mill, which typically contains multiple heavy, complex machines at every stage of the production chain, from woodyard to shipment. During the lockdowns, compa-

nies understandably struggled to get as many staff as possible onto the shop floor to perform preventative maintenance rounds. Having the right people, with the right expertise, in place to perform these physical inspections must once again become a priority. Without this, operators will struggle to maximize uptime and identify and mitigate the effects of harsh mill conditions - such as dirt, dust, pulp and moisture build up - which can impact even the most reliable of equipment.

IT MAY RUN, BUT WILL IT WIN?

While the need for maintenance is there, regular rounds can still be a hurdle due to a lack of support or specific expertise. This is where the latest extensions to traditional systems can add real value. Using data in a smarter way allows mill operators to visualize the pulp and paper production chain from end to end and make informed decisions that optimize production and profitability. It also frees up personnel from performing repetitive manual tasks to focus instead on more valuable, mission-critical processes.

If you were able to measure electrical components of your quality control system, such as a sensor lamp or x-rate tube for example, you could identify an issue before it happens by monitoring variability and setting alerts. The same is true for mechanical issues. If sensing planes need to be cleaned, a standardized failure occurs. Mills can then continue maintenance more efficiently, and where its most crucial, while avoiding unplanned downtime and/or after-hours support.

Smart data management also helps offset skills gaps by providing maintenance and operations personnel with raw analytics and reporting in real time in the form of intuitive online dashboards, allowing them to visualize information that has been automatically curated and calculated.

I'm going to return to my automobile analogy here, this time with a Formula One car. The people in the pits are provided with detailed

information on every aspect of the car's performance, but that data needs to be gathered into a single environment and analyzed if it is going to be of any use.

Just as you wouldn't race a F1 car one weekend, put it in a truck, drive to the next city and just race it again - "it may run, but will it win?" - digital solutions not only provide the crucial information that teams need to protect the system; they also enable ABB experts anywhere in the world to log on and help the on-site team at the mill see the bigger picture and diagnose the issue before it impacts production. In this way mills can continually optimize operations by monitoring mechanical, electrical and calibration signals, but success won't be achieved if disciplined physical inspections are not put in place alongside.

CONCLUSION

Digitally enabled systems and solutions, installed and maintained in collaboration with a specialist technology provider, are successfully bridging the gap that has traditionally existed between information technology and operations technology. This is helping producers to reduce production and maintenance costs and maximize uptime and quality control. A saving of even one percent in terms of extra production, or 0.5 percent, say, in terms of fiber usage can equate to many millions of dollars saved in the context of large, asset-heavy manufacturing operations.

Digital solutions can also be enormously beneficial in helping manufacturers monitor and optimize resource consumption to reduce their carbon footprint, particularly in pulp and paper mills where energy consumption can be significant.

However, investment in human capital is also crucial to maintain service levels and preventative maintenance, as well as to ensure that our industry continues to attract the best talent. I believe that technology and talent is the unique partnership that will ensure the continued success of the pulp and paper sector.



Starch applications in curtain coaters: Cargill pioneers bio-based coating solutions

Article by *Diego Fort, Senior Industrial Specialist at Cargill*

For many years, curtain coating has been a commonly employed method in the photographic paper industry. However, it is now gaining recognition as a promising technology for the specialty coated paper industry.

coating, we may influence certain characteristics related to how the paper can be further processed and what the end product looks like. The most important parameters affected by coating are the visual properties such as printability, smoothness, gloss, and brightness.

Today, the use of nature derived, and biodegradable binders is gaining traction in the paper industry. In this context, Cargill, a leading provider of food, agriculture, and industrial products, is at the forefront of developing starch applications for curtain coaters that provide excellent product quality and runnability.

Coated packaging paper and board are an essential part of our daily life. By coating paper surfaces with a curtain



1. Curtain coating formed during lab trial at PTS.
2. Curtain coating pilot trial.
3. Optimal filament length and stability.
4. Lab set up for Curtain Coating experiment at PTS.

CURTAIN COATING: AN OVERVIEW

The technology of curtain coating has been historically used in the production of photographic papers due to its outstanding quality and its ability to apply very thin layers simultaneously. This technology provides perfect coverage, excellent runnability, less breaking time and can reduce the drying energy when used at high solid contents, compared to film press and blade coater. Curtain coating is a contactless contour coating process where the coating is applied through a curtain formed by a slot dye. In this way, the coating is uniformly distributed, leading to a smooth and even surface.

The technology of curtain coating is growing with new machines and rebuilds for printed packaging and barrier applications due to bene-

fits in production combined with better paper surface quality as the solution is a contactless contour coating. Our internal research basis public data have shown that in Europe a total of 2.6MM MT/Y of paper/package is coated using curtain coating and this quantity is expected to grow further in the future.

STARCH APPLICATIONS IN CURTAIN COATERS

Nowadays, curtain coating is mostly used with a full synthetic binder system, while starches have been established for use in all other graphic coating applications for decades. However, there is a growing interest in using nature derived and biodegradable binders in curtain coating, especially for packaging applications.

C*Film™ starch solutions provide great runnability, processability, and very good product quality in curtain coating applications. The use of starch as a nature derived binder meets the technical requirements and the industry's need to move towards more sustainable and biodegradable solutions. The benefits of using starch as a binder in curtain coating include improved printability, smoothness, and glossiness of the paper surface. Starch also tends to provide good adhesion and reduces dusting and picking.

The technology of curtain coating is challenging and requires specific knowledge to understand the parameters of the coating formulation that are essential to enable a smooth application in practice. Therefore, Cargill's EU-based project team focused on understanding the key requirements of curtain coatings, and the advantages in using starch when compared to current standard formulations by developing a specific testing methodology and plan suitable for this application.

PIONEERING BIO-BASED COATING SOLUTIONS

Thanks to the rise of online shopping, the packaging business is expected to be growing, and the method of coating seems to be changing

with a renewed focus on replacing synthetic binders like latex with more bio-based materials. The first question we had to ask was whether we could replace latex with starch, and what success criteria we would need to evaluate it on.

With practical experience and results, we first ran a couple of formulations on a lab trial at the Papiertechnische Stiftung (PTS) Institute in Germany. This small exploratory study demonstrated that existing starch products can be applied in a curtain coater once the coating formulation is correctly adopted. It is not enough, however, to simply replace 50% of the latex with 50% starch as it doesn't have the right characteristics. We found that the filament length wasn't sufficient, so our team had to determine how to optimize the formulation to reach the required filament length.

The project team also investigated the rheological properties of the starch-based formulations to ensure that they met the specific requirements of curtain coating applications. By adjusting the viscosity and flow properties of the starch-based solutions, the team could achieve the desired coating thickness, uniformity, and coverage on various substrates.

In addition, the team explored the effect of the starch-based coatings on the final product's mechanical properties, such as adhesion, scratch resistance, and flexibility. It is one thing to conduct lab work, but another to conduct a pilot study on real machinery to see if it works. A three-day pilot trial at an external pilot facility helped us identify one of the most interesting ways to use curtain coatings by combining it

with a blade coating. We found that if you first apply the curtain coating as a pre-coat, then blade coating as a topcoat it helps bring out the best features of both coating methods.

THE FUTURE OF CURTAIN COATINGS

The research on starch-based coatings for curtain coaters is still in the early stages, but the preliminary results are promising. This investment in R&D helped us demonstrate how starch can be used as a partial replacement of latex, providing good runnability as well as good product quality. The team is confident on the future development of a starch-based formulation that will not only match but exceed the performance of the current synthetic polymer binders. Furthermore, the team is also aware of the sustainability advantages of using starch as a binder instead of petrochemical-based polymers.

At Cargill we envisage working on replacing 100% of the latex in coating formulations, with an ambition to offer our customer 100% bio-based solutions in the future.

As the paper industry continues to adopt packaging papers and barrier applications as an alternative to synthetic materials, the potential market for curtain coating is substantial. The technology of curtain coating is challenging and requires specific knowledge to understand the parameters of the coating formulation that are essential to enable a smooth application in practice. Cargill is taking on this challenge by answering key questions and developing products that help meet the requirements of curtain coatings.

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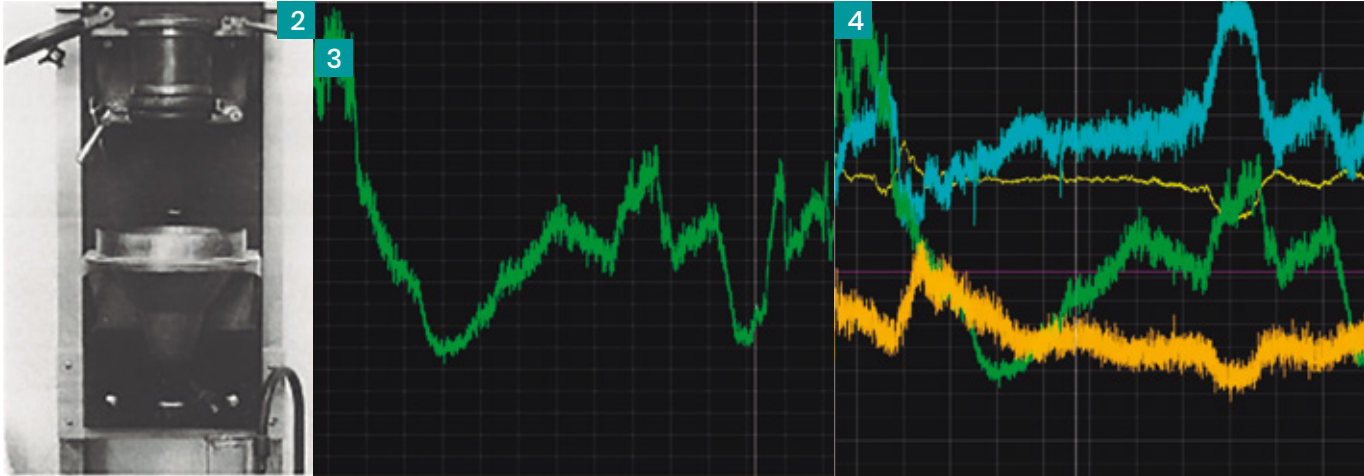
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Entrained Air Management on Paper Machines

Article by
Bret Magness, Global Business Development Manager, Buckman
David Wolfanger, Division Manager – PT ECHOWISE®, Buckman

Figure 2. Canadian Standard Freeness tester²

Figure 3. Ackumen™ ECHOWISE® Entrained Air Data (% entrained air over time)

Figure 4. Entrained Air with Drainage Measures
 Green=air; Blue=Couch; Yellow=Gamma gauge consistencies before top wire; Orange= Gamma gauge consistencies after top wire

Entrained air is a variable that must be addressed in nearly every paper machine system. It is a disruptor, and when entrained air is high and/or fluctuating it impedes wet end drainage. When wet end drainage suffers, production and quality suffer. Proper management of entrained air is key to managing costs and driving value in paper machine operations.

Kappa	Stock pH	Refining
Additives	Filler loading	Fines loading
Thin stock consistency	Entrained air	Temperature

Figure 1. Paper Machine Drainage Drivers

The modern papermaker spends significant time and effort in the pursuit of measuring and controlling many of these variables.

A Look at the Past and Current State of Measurement of Drainage Variables

- In past decades, many of the listed drainage variables were measured through lab-based testing.
- Freeness testing was performed using a Canadian Standard Freeness tester as seen in Figure 2.
- Consistency measurement was done as a manual wet lab test.
- pH was measured through titration.

While these tests are still in use, today there are many online measurement tools that allow the modern papermaker to collect real-time information to base operational changes upon.

PAPER MACHINE WET END DRAINAGE

Drainage rate and stability are critical to reliable target performance in papermaking operations. Wet end drainage rate can be impacted by any of many variables feeding into the wet end of the paper machine.

Feed Stock Conditions Impacting Drainage

There are many different qualities related to paper machine feedstock that can affect the rate and stability of wet end drainage. These include:



Sample frequency	Accuracy	Sampling flexibility	Data accessibility
Reliability	Consistency of measurement	Application flexibility	Actionability - timeliness

Figure 5 - Needs for paper machine entrained air measurement

From online Kappa analyzers to continuous consistency measurement, modern techniques provide significant advantages over previous tests in one key area - measurement frequency. Now these measurements are collected rapidly and in real time. This speed of measurement can allow for real-time decision making in the high-speed paper production process.

Entrained Air Impact on Wet End Drainage

One drainage driver that has not seen this modernization in its measurement technique is entrained air.

An improved technology to measure entrained air on a paper machine in real time can produce results as seen in Figure 3.

Figure 3 is a graphic capturing just over 24 hours of real-time thin stock loop entrained air from a paper machine. The range of air variability shown is around 1.0% air from high to low, common to many paper machines.

Many papermaking operations rely upon visual cues to determine the degree of entrained air in the papermaking system. This is observed as the presence of foam.

Foam in a papermaking system is a lagging indicator of entrained air. Foam is produced when entrained air is allowed to come to atmospheric pressure in the presence of some level of surfactant.

While foam is a visual cue and can cause some minor problems around the paper machine, it is an indicator of the more severe problem of entrained air. Entrained air can act much like excessive fines in a paper machine system, slowing the movement of water through the drainage pathways in the paper web.

When several wet end drainage measures are added alongside of the entrained air information from Figure 3, it can show the impact of entrained air on wet end drainage.

Figure 4 demonstrates how entrained air can drive the vacuums and flows on the forming section of the paper machine. As can be seen, the couch vacuum on the paper machine very closely tracks with entrained air variability. As air goes up, vacuum increases, indicating a wetter sheet at the couch roll.

Once it is established that entrained air can drive drainage variability on a paper machine, it is important to try to understand the tools available to measure entrained air. It is also important to discuss what is needed from an entrained air measurement.

Figure 5 speaks to the need for real-time data that can be used to adjust paper machine or additive setup. This information should be reliable, consistent, and accurate with a measurement that is collected from a location that is relevant to the impact to drainage on the paper machine.

Entrained Air Issues and Costs

A primary issue that occurs when entrained air levels are high is a negative impact on wet end drainage. When drainage suffers there are several negative impacts to paper machine operations:

- Sheet formation and moisture profile
- Machine slow down impacting production
- Chemical costs rise if additives are used to create drainage
- Potential strength/sizing issues created by additive overuse

The correlation between entrained air levels and sheet breaks in one mill can be seen in the graphs below. The yellow line on the graph shows production with each steep drop showing a break. The blue line shows the level of entrained air measured in the system.

Quality issues also become a factor. Pin holes, sheet smoothness, strength, and sheet basis weight profile are all issues that can cause production to be downgraded or culled.

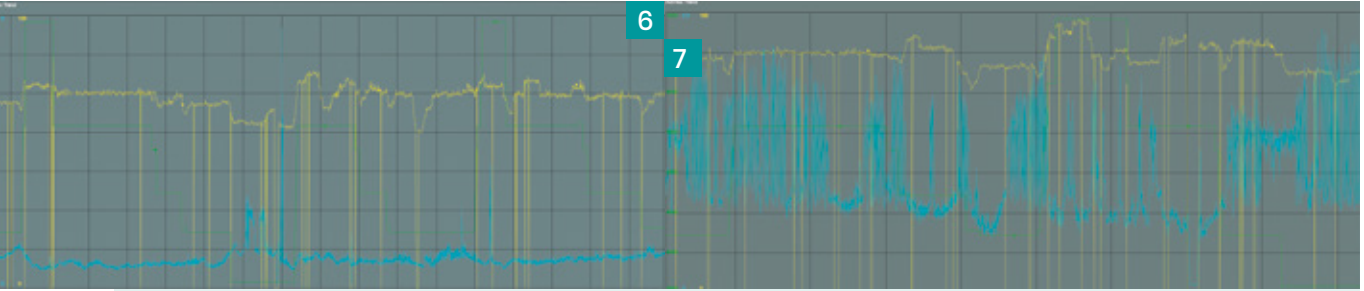


Figure 6. Air variability and production – Low variability period, 27 breaks in 18 days = 1.5 Breaks per Day Yellow=production; Blue=entrained air
 Figure 7. Air variability and production – High variability period, 27 breaks in 9 days = 3 Breaks per Day Yellow = production; Blue=entrained air

Finally, poor drainage can result from a variety of issues, not just entrained air. In the absence of entrained air information an operator is left to guess at which lever to pull to correct drainage, often inducing additional variability.

Refining +/-	Speed +/-	Vacuum levels +/-
Dryer steam +/-	Chemical usage +/-	Headbox consistency +/-

Figure 8. Process variables

Now the focus will shift to methods for entrained air measurement. When air can be measured, it can be controlled. When air can be controlled, variability can be taken out of the process.

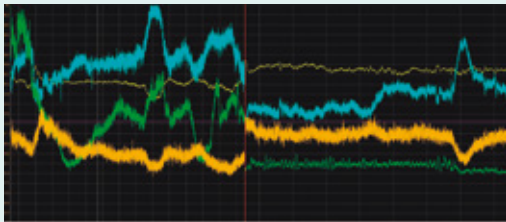


Figure 9. Entrained air and drainage trends before (L.) and after (R.) Ackumen™ ECHOWISE® control established.

HISTORICAL METHODS FOR MEASUREMENT AND CONTROL OF ENTRAINED AIR ON A PAPER MACHINE

For most of the history of papermaking operations, operators have relied upon visual observation of foam levels. Based on this visual inspection, the operator would increase or decrease the amount of defoamer chemistry being dosed into the paper machine. This is a problematic method for the paper maker.

About 50 years ago, the EGT (Entrained Gas Tester) was produced. This EGT, as shown in Figure 10, provided a manual test method to directly obtain the entrained air level of a paper machine feed stock. The EGT provides a significant upgrade to visual inspection of atmospheric



The Entrained Gas Tester (EGT) is used for determining the percentage of air that is entrained in a solution. For over four decades the pulp and paper industry has been using the EGT to measure the air content in solutions from pulp and paper washing and bleaching to the paper machine and coatings. Others have been using it for checking out their cooling towers or checking the air content of liquid solutions that are compatible with cast acrylic.

Figure 10. Entrained Gas Tester (EGT)1

ric vessels. The EGT involves the collection of a known volume of a stock at atmospheric pressure, which is compressed to determine the air within the slurry.

The EGT is reliable if the sample collector is knowledgeable and conscientious about how the sample is collected. If the test is performed consistently, it can provide repeatable results; if not, significant error can be introduced.

The EGT test can take time to perform and then be logged or relayed to a process operator. The operator must then decide if a machine setup change is needed. In the high-speed operation of a paper machine, the sample test value may no longer be valid by the time an operator makes a response.

A new approach collects accurate entrained air measurement in real time such that the paper machine operator can correct it before drainage is impacted.

THE ACKUMEN™ ECHOWISE® APPROACH

ECHOWISE® technology from Buckman uses real-time measurement to produce a continuous



Figure 11. Ackumen™ ECHOWISE® units installed

stream of entrained air information, collected at a rate of about one measurement per second.

ECHOWISE sensors are placed on process piping in locations on the thin stock loop of the paper machine to collect relevant entrained air information.

Data Accessibility

As the ECHOWISE unit collects entrained air data, this data can be collected from the unit via USB stick (for manipulation in Excel), through connection to one of two 4-20mA outputs, or by MODBUS connection.

Reliability

ECHOWISE technology collects entrained air information non-invasively through the wall of process piping. This method provides inherent reliability. There are no moving parts, no obstruction to process flow, and after installation no additional calibration.

Frequency and Accuracy

A critical property of the entrained air measurement is accuracy and repeatability. A look at a collected data comparison of ECHOWISE and EGT test data can reveal that accuracy, frequency, and reliability are linked together when measuring entrained air on a paper machine.

Figure 12 shows a comparison of collected EGT and ECHOWISE entrained air information. This graphic shows movement of both the EGT and entrained air information. There are four collected EGT data points in just over a month of collected data. This is not an actionable data collection rate.

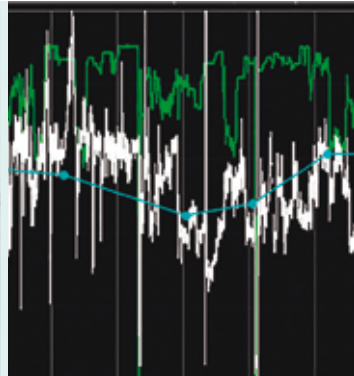


Figure 12. Approximately 30 days with four EGT values vs ongoing measurement with ECHOWISE. Green=ECHOWISE data; White=reel speed; Blue dots=EGT measurements

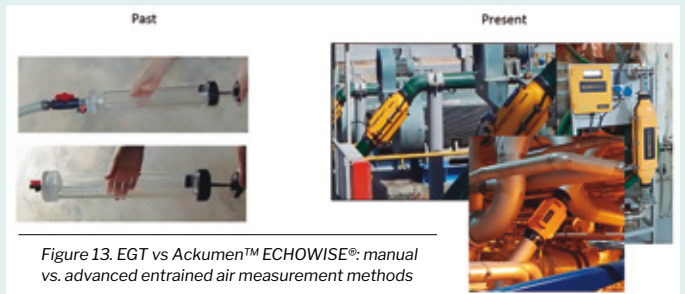


Figure 13. EGT vs Ackumen™ ECHOWISE®: manual vs. advanced entrained air measurement methods

In this period, the ECHOWISE unit has collected roughly 2,000,000 entrained air test values. Both measurement methods show repeatability and accuracy, but only the ECHOWISE measurement has collected enough data to show true reliability.

As discussed at the beginning, there are many variable inputs to the paper machine that can affect wet end drainage. While there have been many technological improvements related to measurement of freeness, consistency, pH, temperature, and Kappa, the papermaking operation has been left using a decades old manual technology to measure entrained air. This is no longer true.

CASE HISTORY

Background Information

- Linerboard machine producing over 1,000 TPD of linerboard from unbleached Kraft pulp with a small amount of recycled content
- Ackumen™ ECHOWISE® 360 unit installed on the headbox return line to the fan pump and put into closed loop control to the defoamer pump feeding defoamer to the whitewater pit

Technical Results

Baseline measurements of entrained air in the system were collected for about two months.

During this time, the average air content in the process was measured at 0.30%. After this time, the defoamer pump was put into closed loop control with the air signal and a set point of 0.10%. ECHOWISE control was able to maintain an average air content of 0.11%.

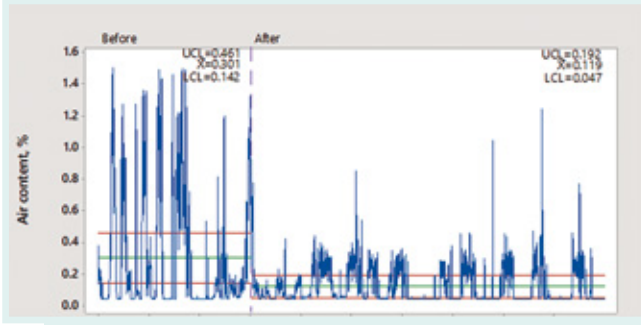


Figure 14. Air variability over time before and after control established with Ackumen™ ECHOWISE®.

Once in control, with the defoamer pump automatically increasing and decreasing as air readings fluctuated, the average defoamer usage was decreased 40%.

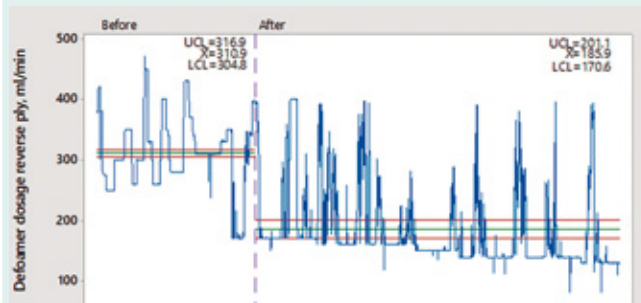


Figure 15. Defoamer dosage before and after control

With consistent management of entrained air levels, and better drainage, the machine was able to achieve an average production increase of 0.7 tons per hour as confirmed with the mill.

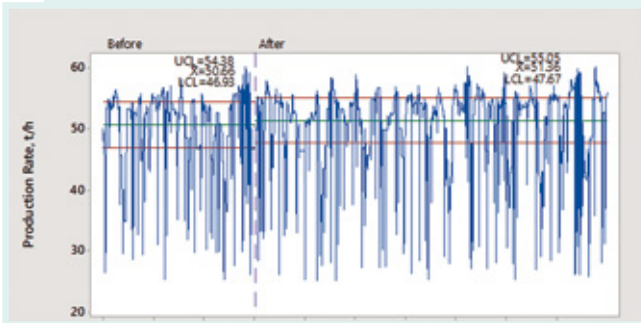


Figure 16. Production before and after control of entrained air

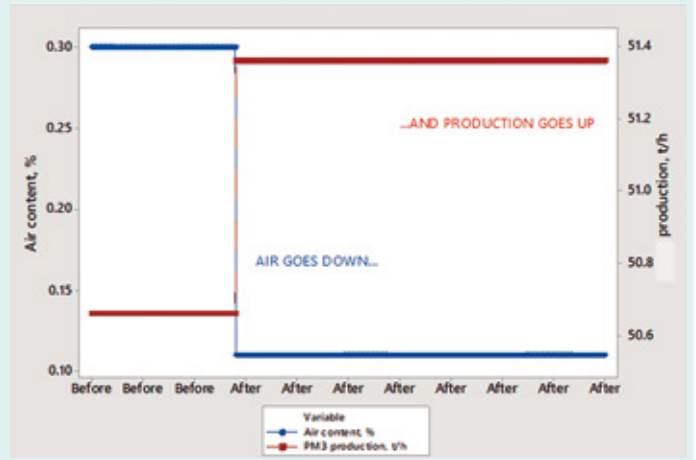


Figure 17. % Entrained air vs production before and after control

Financial Results

The decrease in defoamer usage delivered US\$30,000 in savings annually.

Production increases were confirmed to be on average 0.7 TPH or 5,880 tons per year. Using US\$250 of profit per ton, the Ackumen™ ECHOWISE® program delivered US\$1,470,000 in increased profits for the mill.



REFERENCES

1. EGT picture from get-tester.com
2. CSF tester picture - <https://www.sciencedirect.com/topics/engineering/drainage-rate>

Voith Paper Sustainability Program
**PAPERMAKING
FOR LIFE**

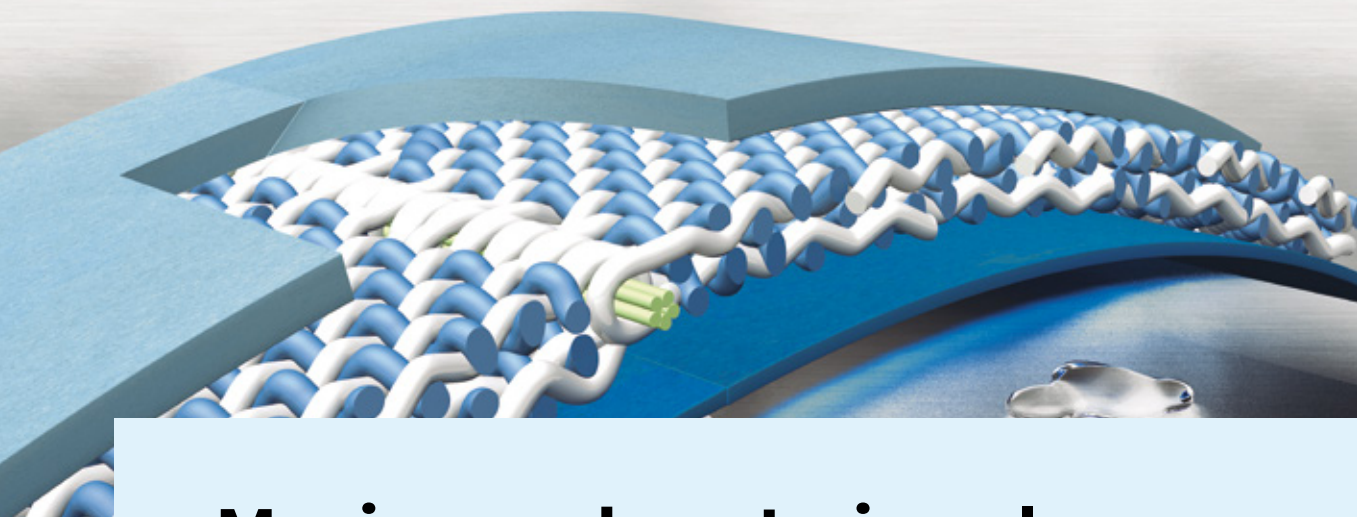
VOITH

**Efficient
technologies
for high
energy savings.**



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Then get in touch with us!

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Maximum dewatering plus energy savings

Article by Frank Kiefer, Strategic Product Manager Pressing, Heimbach

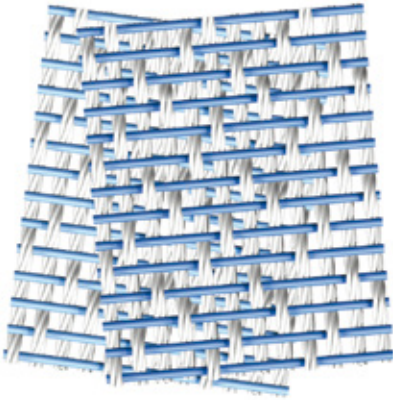
Faced with a backdrop of spiralling energy costs paper manufacturers are more than ever confronted with the difficult task of keeping the cost of production as low as possible. The motto is – less energy, more productivity. The implication of this is that paper machines have to be pushed to their performance limits: High machine availability, optimum runnability and maximum possible speed are the focus. A top priority in achieving these goals would normally be to obtain maximum dry content coming out of the press section. This, of course, places high expectations on the performance of press felts. Atromaxx and Atromaxx.Connect from the NewTech product portfolio are well placed to satisfy these expectations.

The concept is based around multi-axial carrier modules providing a structure that is essentially incompressible. On the one hand, this allows a designated void volume to be maintained throughout the lifetime of the felt, whilst on the other hand the open drainage channels are able to handle large volumes of water. The result: exceptionally high dry content! Thanks to its modular design, Atromaxx is highly versatile in terms of paper grade application as well as speed range and, combined with a suitable non-woven layer, should be suitable for every machine and nip configuration.

TURN OFF UHLE BOXES

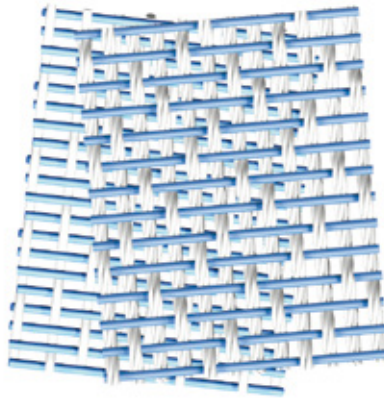
Nip dewatering can come into play when machine speeds exceed 600 m/min, making it possible to reduce – or even completely switch off – vacuum in felt suction boxes. When this occurs, the door is opened to huge energy savings. A prerequisite for this would be an individually designed and precisely matched press felt design such as Atromaxx, whereby higher dry content, better runnability and faster start-up can be realised. Numerous references provide compelling confirmation of this.

1



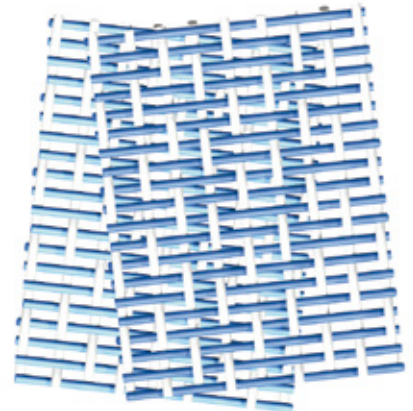
Combination twisted/twisted

2



Combination twisted/mono

3



Combination mono/mono

UNMATCHED FLEXIBILITY

The dewatering behaviour of a press felt is significantly influenced by machine speed, pressure pulse and felt saturation level. So, at speeds below 600 m/min nip dewatering is more or less impossible. Even under these conditions, however, Atromaxx can achieve considerable dry content values. This flexible design can come into its own on machines where, depending on paper grade, speed fluctuations necessitate switching between nip and suction box dewatering.

SAFE AND FAST

The outstanding properties of conventional Atromaxx are certainly replicated in the seamed version of the felt. Atromaxx.Connect can be installed quickly and safely while requiring few personnel and brings the additional benefit of drainage values that conventional seamed felts cannot match. High speeds are no problem either, as the seam area and seam itself are designed with this in mind.

Atromaxx.Connect – the seamed version offers the same dewatering performance with safe and fast installation.

www.heimbach.com

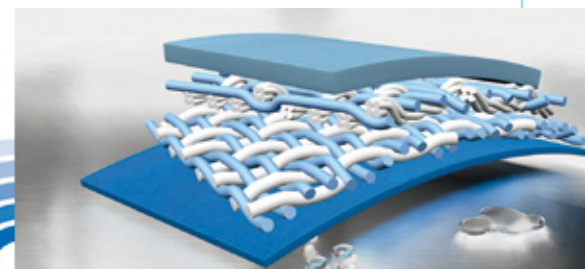


Atromaxx.Connect cross section

THE ATROMAXX FAMILY - PRODUCT FEATURES

Multiaxial felt

- Modular construction: Combination of totally different base properties possible within one felt
- Outstanding compaction resistance due to multiaxial structure
- Outstanding void volume retention
- Absorption of huge amounts of water
- Excellent dewatering throughout felt lifetime
- High stability
- Operation modes for nip and uhle-box dewatering
- Applicable for all paper grades



NEWTECH MULTIAXIAL



Excellent dewatering



High compaction resistance



High void volume

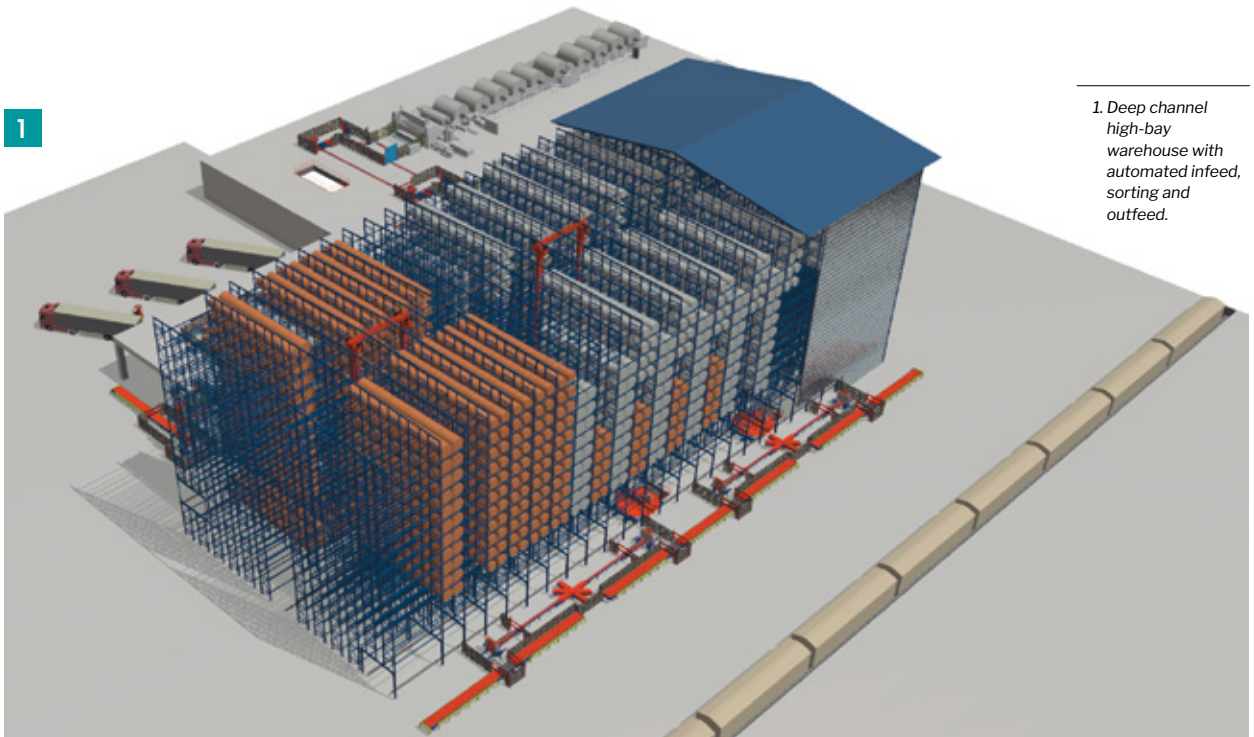


Dimensional stability



Long lifetime

1



1. Deep channel high-bay warehouse with automated infeed, sorting and outfeed.

Developing business through enhancing in-mill logistics

Article by *Kaj Fahllund, Vice President, Pesmel Corporation*

In this article, we explore the benefits of enhancing in-mill logistics, including reduced downtime, lower inventory costs, and improved safety and sustainability. Pesmel's expertise is valuable when implementing innovative solutions for streamlining material handling, transportation, and storage within the mill.

THROUGHPUT UP, NO ERRORS IN DELIVERIES

Companies that have taken the leap into industry 4.0 in terms of their supply chain are reporting astonishing results. By improving the speed, accuracy and efficiency of logistics operations, many have significantly enhanced their business performance. Automated solutions regularly report zero errors in deliveries due to the elimination of the component of human error. In some cases, improved supply chain has helped boost annual sales by up to 15%.

It is becoming clear that as production volumes grow, delivery schedules keep tightening and deliveries are more and more complex, traditional warehouse, loading and transportation methods are no longer able to meet the needs of today's business. Many of the industry frontrunners are bringing their supply chain logistics into the 21st century by investing in advanced automation. The potential to improved efficiency in logistics is great, yet still largely unrecognized.

Due to their capabilities automated warehouses are becoming a vital part of the supply chain. This article focuses on high-bay warehouse solutions based on horizontal deep lane technology, suitable for big storage volumes and high capacities. Virtually unlimited handling and sorting capacity sets the solution ahead of other alternatives.

Automated high-bay deep lane warehouses can handle both rolls and roll sets without limitations related to roll dimensions or packing variants. This enables handling and control of large amount of stock keeping units (SKU).

In order to an automated warehouse to function in the most efficient way modern control structure is a necessity. A Warehouse Management system (WMS) is used to integrate the various mill functions into one logistic entity. WMS and its integration with other mill systems is a key element in building an efficient supply chain. Simple warehouse inventory is not enough anymore, it is essential that WMS has the ability to optimize material flows and efficiently utilize the storage locations inside the warehouse. This ensures optimal organization and operation of the warehouse with no bottlenecks in the mill's material flow.

Optimizing warehouse operations lays the foundation for improvements over the entire supply chain. "Automated warehousing increases efficiency, reduces costs, and simplifies often complicated material flows. For example, with the help of automated warehouse you can optimize the size of your production batches for each process separately. This will help you to achieve the best possible utilization rate and a higher production output", says Tony Leikas, CEO of Pesmel.

Adjusting material flows to follow the market cycle is one of the areas where significant results can be achieved. Awareness of product market cycles enables use of historical data to modify operations and production plans. A combination of collected data and company's sales intelligence offers new opportunities to react to changing markets. In other words, an automated warehouse with logistic functions enables market cycle follow-up, ensuring that a right amount of products is ready for delivery at all times. Hence, an efficient warehouse will enable a proactive approach to customer needs, helping to revamp the entire sales and production strategy.

Lastly, it is important to note that improvements in in-mill logistics will boost several areas of mill performance, finally reaching all the way through the entire supply chain.

STORA ENSO OULU – AUTOMATED SHIPMENT WAREHOUSE AS A DISTRIBUTION CENTER

Stora Enso has recently decided to invest in an automated high-bay warehouse facility at their Oulu mill in Finland. The delivery includes a 40,000 metric ton automated warehouse with transfer cars and conveyors for board roll logistics. The system operates as a distribution center between two board production lines and the port operator. The warehouse receives rolls from production and organizes them automatically into correct shipment batches. Most of the production is shipped as sea freight via a deep-water harbor located next to the mill. The remaining rolls are transported by trucks or train to their destination.

High handling capability and flexibility are fundamental to automated high-bay warehouse solutions. Integrating them to the mill's material flow is easy, and the footprint of the warehouse is smaller compared to other solutions. This is an important factor in confined mill and port areas.

Integral part of the solution is the Warehouse Management System (WMS), which controls all material flows and shipping functions within the warehouse. The system identifies every roll and automatically organizes the shipments according to the orders.

The WMS enables smooth sorting and out-feeding of rolls with high volume, which shortens the turnaround times of ships and trucks considerably. An integrated software solution developed for these types of needs enables smooth integration of equipment with upper-level data management system without external inter-phases.

TRAIN LOADING AND TURNAROUND TIMES HALVED

"We know that the transportation of goods can take less than half of the total time of the supply chain process, and that opportunities to reduce this time further are limited. This means that the biggest potential for time savings in the supply chain occurs at turnaround points where goods are loaded, unloaded, and stored", states Leikas.

2

In-Mill Logistics

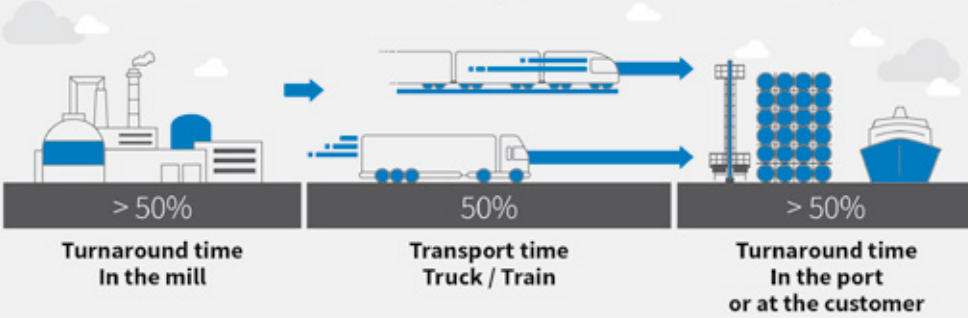
Equipment automation
Industry 4.0

Roads and Rails

Investments in infrastructure
Industry 4.0

Port or Customer

Investments in infrastructure
Industry 4.0



3

3. Unmanned high-bay pulp warehouse and distribution center with automated train loading.

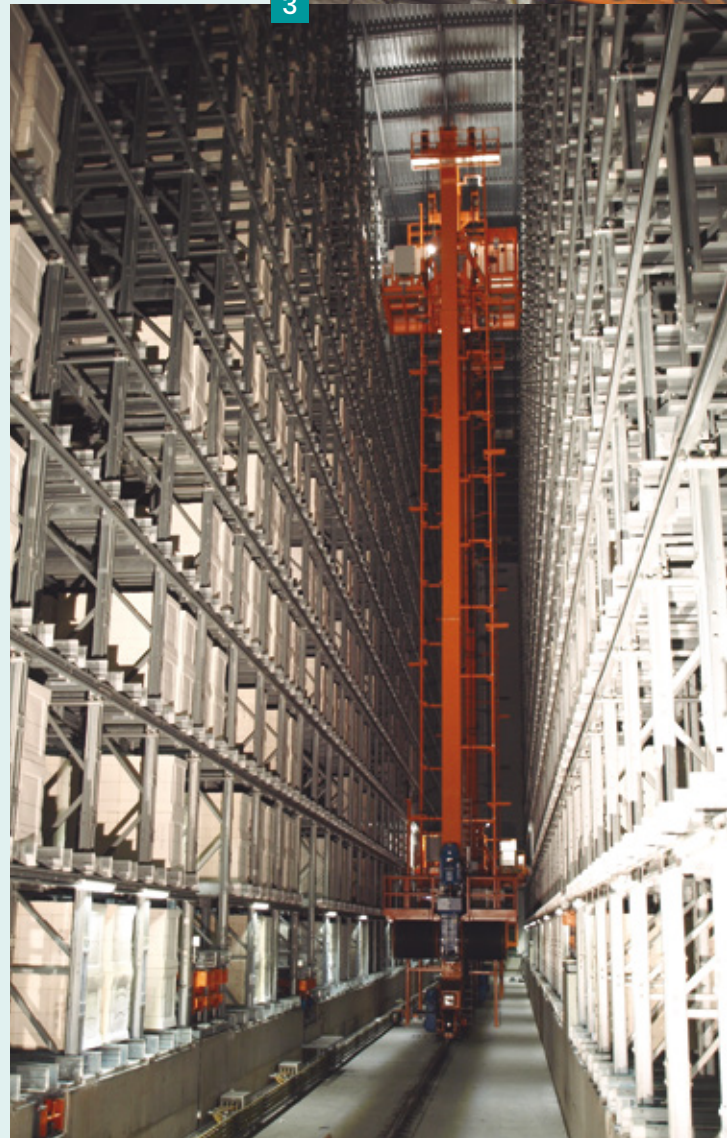
Reducing waiting and turnaround times through proactive and predictive operations and the smart sharing of information has the potential to really impact business performance.

Due to high-bay warehouse's nature of having high performance in a compact structure enables great reductions in train loading and unloading times, and the round trip from mill to port and back can be cut from four days to less than two, for example (Fig. 2).

MINIMIZING TRUCK TURNAROUND-TIME

For trucks, the equation for improving transport capacity is simpler – get more trucks. But the bottleneck is still the loading and unloading times, and getting more trucks does not help there, either. In traditional pulp and paper mills, large areas have to be set aside for trucks to sit and wait to be loaded, and the waiting times can be very long. With automated warehouse the waiting times are much shorter and the drivers are able to take care of all the loading by themselves. When the products arrive at the loading bay, the driver loads the truck themselves with a forklift truck.

The solution's ability to bring the right products to the right bay in very little time means that the entire loading process takes under 20 minutes, from the time the driver registers at the bay. Trucks spend less time waiting, consequently being able to deliver the products quicker. An automated warehouse is also a great deal more economical to implement, with the investment





4

4. Automated high bay warehouse at Saica El Burgo de Ebro mill in Spain.

business platform (SAP), The Warehouse Management System (WMS) and the port systems, the outgoing loads are pre-sorted and ready for loading when the train arrives.

In addition, the automated loading process is much faster than traditional manual loading. Loading of 1 408 metric tons of product only takes three hours in total. The scheduling information and tracking of train cars combined with a detailed load list enables the same time savings when unloading the train cars at the port.

SAICA IN EL BURGO DE EBRO - AUTOMATED LOAD FORMATION CUTS TRUCK TURNAROUND TIME TO 20 MINUTES

Equally impressive improvements have been achieved at the Saica (S.A. Industrias Celulosa Aragonesa) El Burgo de Ebro mill in Spain, which use trucks exclusively for primary transportation. The mill has up to 250 trucks pull up in random order each day for pickup. Prior to the investment, valuable time was being lost in shipment sorting and loading. By building an automated warehouse alongside the production facilities and increasing the level of automation and data utilisation, Saica was able to reduce the turnaround time for arriving trucks from two hours to a mere 20 minutes.

These remarkable improvements were the result of a highly organized 65 000 metric ton

being marginal compared to investments in other infrastructure.

METSÄ FIBRE IN ÄÄNEKOSKI, FINLAND - HIGH UTILIZATION RATE OF ROLLING STOCK

In Metsä Fibre Äänekoski pulp mill in Finland Pesimal's automated logistics solutions help the customer to reduce the round-trip time for a 320 km rail transfer from mill to port from 96 to 36 hours. The trains still run at the same 24-30 km/h speed using the state-owned rail network. These savings simply come from shorter waiting time en route. Thanks to active networking and data sharing between the customer's

high-bay warehouse facility with four stacker cranes, four sorting cars and 12 truck loading positions, all monitored and controlled by Pessel's Warehouse Management System (WMS). Integrated WMS allows for automated handling of up to 4000 Stock Keeping Units, efficient pre-sorting of outgoing loads and delivering them to the allocated loading points in advance.

The 1,3 million ton annual capacity Saica mill was in full operation throughout the commissioning of the high-bay warehouse. Introduction of the new warehouse allowed Saica to implement new supply models based on stock such as VMI (Vendor Managed Inventory) and MTS (Make To Stock) models.

Successful commissioning at the El Burgo de Ebro mill was enabled through building of a unique WMS digital twin. It is an environment where a fully functional WMS is expanded with in-built simulation engine. The simulation engine includes a physical device model which performance is based on collected data. This combination enabled virtual commissioning prior to actual start-up. After start-up targeted level of operational efficiency was achieved from day one.

PROJECT VALIDATION THROUGH SIMULATION ANALYSIS

An investment into advanced supply chain automation and industry 4.0 connectivity is an simultaneous investment into productivity and efficiency. To ensure that each project has what it takes to deliver the expected results, an in-depth feasibility study is made before executing the planned automation of in-mill logistics and shipping functions. A comprehensive simulation is a minor investment that justifies the overall investment and brings peace of mind for the paper maker.

Simulation is used at an early engineering phase to analyze material flow in a given location accurately. This allows a shared vision to be developed between the customer and supplier. Simulation makes it easy for the customer to visualize the solution and approve it prior to making further investments. For supplier, the data

gathered provides greater understanding of the customer's process and integration needs, which allows solution optimization.

There are three main phases of simulation. The process begins with collecting customer data such as product dimensions, warehousing requirements, and the dispatch needs of the planned material flow system.

The next step is solution engineering, including data analysis and layout design. It also involves a capacity simulation providing a visual presentation and validation of the tailored solution. Finally, the simulation facilitates the design and workshop testing of the Warehouse Management System for automation control, the heart of the material flow solution.

Simulation is run using the same WMS that will be in real use later. This process helps provide a realistic overview of what can be expected and validation for the project based on real data and analysis. The built simulation model also acts as a digital twin for the customer's process, allowing for future simulations and pre-implementation testing of new developments.

INVESTMENTS IN LOGISTICS AUTOMATION WILL ENHANCE THE ENTIRE SUPPLY CHAIN AND REDUCE CAPITAL TIED-UP

Investments in automated logistics operations will boost the performance of the entire supply chain. Added intelligence in storage, sorting and distribution functions means that companies have up to 40% less capital tied in products sitting in the stock yard or warehouse. With the right partner planning of automated logistics is carried out systematically, risks minimized and significant savings in time and money achieved. The delivered systems are proof of successful automated logistics projects that have enhanced the efficiency of the entire supply chain while offering great returns on investment with a lower total cost of ownership. To tap into the great unrecognized potential for increasing efficiency across the entire supply chain, automation solutions are ushering in a new era in smarter logistics.



Techpap, your partner for recycled pulp quality monitoring & optimization

Article by *Techpap*

With the proven expertise from the CTP – Centre Technique du Papier, created in 1958 in Grenoble, France – TECHPAP has developed a range of advanced solutions to monitor the quality & to control production processes based on recycled fibers with proved return on investment

3D Stick evaluates the contamination of recycled fibers, characterizing the morphology, quantity and composition of the particles, to avoid the problems of uncontrolled stickies in the paper machine.

The results bring morphological information of the stickies - length, width and volume - as well as of the population of stickies, presenting average values and distributions, according to their nature (PSA, PVA, plastics, etc).

Thus, it is possible to adjust its chemical response to the different types of contaminants that enter the process mixed with the fibers in the bales of recycled paper, optimizing costs and guaranteeing quality.

Techpap proposes MorFi, a family of fiber morphology analyzers according to ISO 16065-2,

which since 1995 helps pulp and paper manufacturers around the world to assess the quality of fiber sources along with their value chain for both quality control, process control, research and development.

MorFi Neo is the laboratory version of our high performance fiber morphology analyzer according to ISO 16065-2.

Accurate, resistant, affordable and with minimal maintenance requirements and costs, it offers a fast, accurate and complete characterization of the entire fibrous population, be it short, long, mixed, exotic, virgin or recycled:

- Fibers
- Fines
- Shives
- Vessels

MorFi Neo's extraordinary capabilities and reliability, combined with its operational simplicity, make it ideal for any purpose, from Research and Development to 24/7 Quality Control, with a fast and assured return on investment.

MorFi HR, the high-resolution add-on module available as an option for the MorFi Neo, provides a powerful research tool for advanced fiber Wall Thickness analysis.



- Camada funcional – material de borracha esponjosa 1Z14
- Camada de ligação - material compósito reforçado
- Camisa do rolo

1: 1Z14 Hybriflex Multilayer Bonding System

SchäferRolls solution 1Z14, the latest generation sponge rubber roll cover

Article by Eng. Federico Barsanti, SchäferRolls

Sponge rubber is an ideal material for roll covers in various applications. In fact, its physical properties offer a variety of useful benefits. Thanks to its special cell structure, sponge rubber has low-weight, compression and resilience properties which make it ideal for demanding applications requiring flexible shape characteristics as well as excellent shock and vibration absorption. In addition, roll covers made of sponge rubber are especially well suited to applications requiring wide and uniform nip conditions and compensation for profile deviations.

new 1Z14 solution: an innovative sponge rubber product which, in addition to the aforementioned characteristics, adds excellent mechanical properties and – in combination with an improved bonding technology – is able to operate reliably under the most severe conditions.

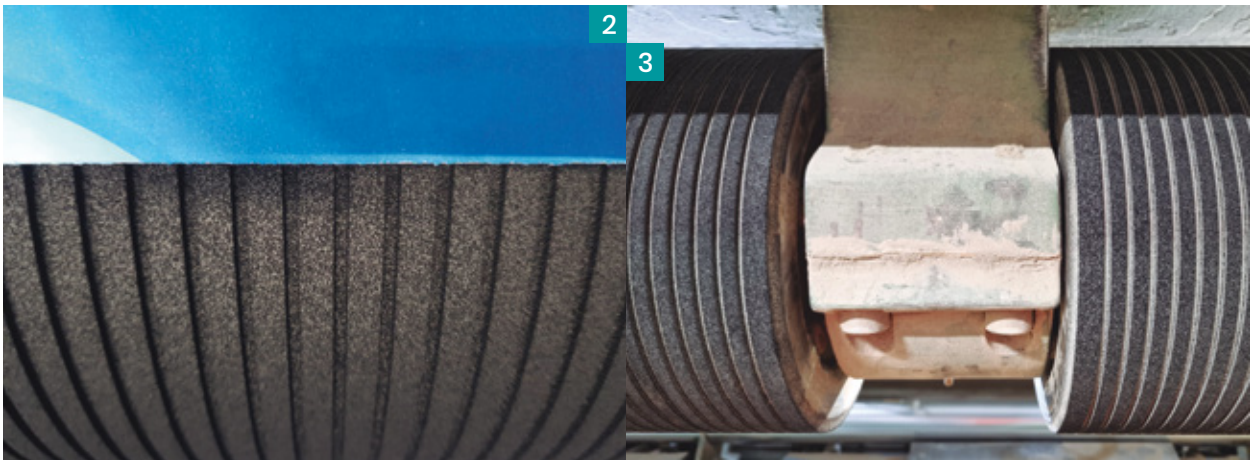
The 1Z14 solution consists of a mixture of polymers designed and produced by SchäferRolls. During the polymerization reaction they are able to create a very fine and homogeneous mixture of closed cells thanks to special catalysts.

This material is not bonded directly to the shell but uses Hybriflex multi-layer technology, i.e. with an innovative auxiliary bonding system called C.protect based on special reinforced composite materials.

The result is incredible: a soft material (hardness 30 P&J), elastic and resilient, totally antistatic, with high thermal (up to 130° C) and mechanical resistance as described below.

SchäferRolls, a long-established leader in the production of high-tech sponge rubber materials, is pleased to present its brand

In fact, in autumn 2020 a well-known Italian paper mill called in SchäferRolls' specialists to solve long-standing problems with sponge



rubber rider roll covers breaking on its winding machine.

Due to structural problems, the machine generates high vibrations and the best covers on the market allowed a cover lifetime of no more than 6-12 months due to continuous breakages.

Smooth and reliable running of the rider roll is decisive for an optimum winding process. Rider roll covers have to offer excellent damping properties, uniform nip conditions and mechanical stability throughout their complete service life. The application therefore provided the perfect test bench for the new 1Z14!

In February 2021 the first rider roll with the SchäferRolls 1Z14 cover was installed in the machine, and the customer immediately noticed a reduction in vibration and excellent compres-

2: 1Z14 Rider Roll Cover

3: 1Z14 Rider Roll Cover after 15 months in operation

sion reset following mechanical impact.

To date, after more than one and half years in operation, not only are there no breakages or damage to the cover, but material wear is below 1 tenth of a mm. The outcome: a significantly higher cover lifetime, excellent winding results and a stable winding process.

The new 1Z14 sponge rubber roll cover from SchäferRolls is therefore an ideal solution for reel drums and rider roll covers of winding machines and for all those applications where excellent absorption of vibration and mechanical shock, excellent compressibility and high mechanical stability are required.

ABOUT SCHÄFERROLLS

SchäferRolls GmbH & Co. KG, based in Renningen, Germany, was established in 1946. With its current staff of over 300 employees worldwide, the company manufactures technologically sophisticated and high-performance roll systems and roll covers for all industries, particularly for the paper, foil, textile, printing, furniture, packaging and metal industry as well as for machinery and plant engineering. Production facilities with a total production area of more than 30,000 m² are located at Renningen (Germany), Brnik (Slovenia) as well as at Farmington, NH and Covington, VA (USA).

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