



# SUSTAINABLE TISSUE PRODUCTION

With *PrimeLine* tissue  
technologies and services

The background of the cover is a scenic landscape. It features a river with white water rapids flowing over grey rocks. In the background, there is a large, lush green tree. The entire scene is overlaid with a large, semi-transparent blue triangle on the left side, which contains the text and logo.

**ANDRITZ**



## ENGINEERED SUCCESS

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### WE CARE - THE ANDRITZ SUSTAINABILITY PROGRAM AND ESG GOALS

ANDRITZ follows a multi dimensional, comprehensive and practice-oriented sustainability approach. Our ESG strategy is based on three main fundamental topics - environmental, social, governance, which are the basis for achieving our ESG goals.

We strive to be a leader in sustainability. We focus on responsible corporate governance and on ensuring a safe and viable future for society, our employees and all other stakeholders as well as on creating sustainable and durable goods that contribute towards conserving natural resources and protecting the environment and climate.

# Technologies for sustainable and energy-efficient tissue production

Sustainability isn't just about how many times a product can be used. It is about how the product positively affects the environment, the economy, and our health and communities. We offer products and services for the whole tissue production process, from fiber preparation, to the tissue machine with fabrics and rolls, pumps, automation and digitalization as well as services, that help to reduce the environmental impact without compromising the quality of the end product.

Even though pulp and paper mills are energy-intensive, our industry is one of the least CO<sub>2</sub>-intensive due to the wide use of bio-based and renewable fuels. The tissue and towel sector, however, emits more carbon per tonne of paper than most other paper grades, primarily due to purchased electricity from fossil-fuel sources.

## THE GLOBAL SITUATION

Pulp & Paper production plays an essential role in many countries' economies. While there are industries that emit considerably more greenhouse gas (GHG) emissions than Pulp & Paper, the industry's GHG output (estimated to be about 9% globally) is large enough to attract the attention of governments and consumers. The GHG most relevant to the paper industry is carbon dioxide (CO<sub>2</sub>), with smaller amounts of methane and nitrous oxide. These emissions are generally reported as mass of carbon dioxide equivalent (CO<sub>2eq</sub>).

## EUROPEAN GOALS

Twelve countries account for 80% of worldwide tissue and toweling production. Carbon emissions from the European Union's (EU) paper industry have reduced by 48% per tonne during the period from 1990 to 2019. The EU has defined a set of ambitious targets to limit the in-

crease in average global temperatures. These include reducing GHG emissions by 40% by 2030 and by 80–95% before 2050 (compared to the levels in 1990).

## ENERGY CONSUMPTION

Specific energy consumption for tissue is highest of the standard grades, primarily due to the drying process. In a study of USA mills, tissue production was second highest in total GHG intensity (behind specialty paper grades) at 1720 kg of CO<sub>2eq</sub> per metric tonne of product from fuel, purchased electricity, fiber, chemicals, and transportation.

There are clearly opportunities and challenges for tissue and toweling producers with regard to reducing GHG emissions and strengthening the relationship with consumers who increasingly prefer carbon-neutral products.



# Less energy, fiber, water, and less chemicals

ANDRITZ offers solutions to reduce a tissue mill's carbon footprint in the categories of energy, fiber, water, biochemicals, and with the help of digitalization.

Our observation, based on decades of personal experience serving tissue customers around the world, is that each mill site is unique. Sure, there are product solutions and technology modules that are "building blocks" for a lot of machines and mills. But generally, these building blocks require our design and engineering expertise, working closely with each mill, to achieve the best results.

Based on our calculations we estimate that a "typical" virgin fiber dry-crepe tissue machine, using conventional technologies (e.g. suction press rolls and cast Yankee) and producing 200 t/d, emits just over 47,000 tons per year of CO<sub>2eq</sub>. This accounts for the stock preparation system and the machine itself, and not for other upstream or downstream processes.

A selection of our technologies and services for sustainable tissue production is presented on the following pages. Each of them having their own ROI benefits, and making it possible to save resources, to reduce kWh/t by up to 17% and CO<sub>2eq/t</sub> by about 15%. These are significant reductions.

## TYPICAL CONSUMPTION DATA FOR A DRY-CREPE TISSUE MACHINE\*

UTILITIES	AVERAGE CONSUMPTION	EQUIVALENT CO <sub>2</sub> EMISSION (*)
Gas	~ 600 kWh/t	~ 132 kg CO <sub>2/t</sub>
Steam consumption	~ 750 kWh/t	~ 165 kg CO <sub>2/t</sub>
Electrical consumption	~ 890 kWh/t	~ 356 kg CO <sub>2/t</sub>
TOTAL	~ 2240 kWh/t	~ 653 kg CO <sub>2/t</sub>
Total per year for production of 200 t/d		~ 47,081 kg CO <sub>2/a</sub>

\*virgin fiber

WATCH THE VIDEO  
on our sustainable  
tissue technologies



# STEP BY STEP TO CARBON FOOTPRINT REDUCTION

UP TO  
**50%**  
LESS CARBON DIOXIDE  
POSSIBLE FOR TISSUE  
PRODUCTION



**FIBER PREPARATION** / PrimeLineTIAC Tissue Innovation and Application Center

# Excellence in fiber preparation for savings

Superior fiber processing means the ability to achieve excellent fiber quality with economical use of valuable resources. ANDRITZ builds on extensive process know-how, highly optimized equipment, and its competence in processing various types of raw materials to focus on fiber production with a smaller ecological footprint.

ANDRITZ has been offering complete mechanical pulping and fiber preparation systems for top-quality tissue production for decades. All our units and systems are designed to have the lowest possible impact on the environment through high operational efficiencies and low energy consumption levels. Nevertheless, ANDRITZ developed certain "technology heroes" for resource-saving fiber production:

## **PULPING AT HIGHER CONSISTENCY**

The FibreSolve FSV pulper allows slushing at a consistency of up to 7% thanks to the outstanding design of its rotor and extraction chamber. As a result, fibers can be treated gently and at low specific energy consumption. With its special mixing vanes, the rotor creates extraordinarily good circulation within the pulper vat. The cleaning vanes keep the screen plate clean, and the raw material is fully disintegrated due to high fiber-to-fiber friction but with less mechanical forces.

## **ENERGY SAVINGS IN REFINING**

Achieving maximum tensile, high bulk and softness by means of optimum fibrillation of fibers are the main targets set by tissue producers. How to combine these targets with energy savings in refining? The Papillon refiner with cylindrical machine concept allows optimum development at the same time offering benefits as to specific energy consumption and no-load energy. Less cutting of fibers and thus

production of less fines not only result in a cleaner work environment, but also in maximum fiber bonding. Required strength properties of the final tissue can be achieved with less energy input compared to competitive refiners in similar applications.

A fiber preparation system with the Papillon refiner can be adapted to changes in throughput more easily since the refiner can operate at far lower minimum throughput. This creates a remarkable benefit for small production volumes – such as for applications with limited use of long fibers. Recirculation flows can be minimized, thus resulting in energy savings.

## **OPTIMIZATION WITH SHORTFLOW BLENDING**

The individual stock components are mixed in one ShortFlow blending system comprising a mixing pipe and a mixing chest. Thanks to the special design of the mixing pipe and to the control philosophy, only a small blend tank is required

ANDRITZ Papillon refiner with cylindrical refining zone.



per line instead of a separate machine tank. Thus, ShortFlow blending enables reduced chest volumes in the approach flow resulting in savings as to pumping energy and amount of circulating water.

A significant benefit for fast grade and color changes and reduced wastewater volume.

## **ADVANCED DILUTION IN THE APPROACH FLOW**

The fiber suspension is diluted right before and again after the headbox screen. A double dilution system enables screening at a consistency of about five times higher than headbox consistency, thus reducing the feed flow volume correspondingly. Smaller headbox screen sizes can be applied. These can be operated with less energy.

## **RESPONSIBLE RAW MATERIAL SOURCING**

More and more customers are focusing on responsible raw material

sourcing, sustainable fiber sources and reuse of waste streams to reduce environmental impact on our planet and make production more circular.

ANDRITZ is constantly working with true pioneers for responsible raw materials sourcing and is continuously developing its technologies for usage of sustainable fibers as alternative to virgin pulp. Our systems are perfectly suited to process recycled fibers of different furnish quality as well as non-wood materials, like wheat straw or bagasse and turn them into high-quality tissue.

To confirm pulp properties and operating characteristics comprehensive trials with numerous raw materials can be conducted in our Fiber R&D Centers in Austria and the USA, providing real-mill environment with small, industrial-scale equipment.



# Test the latest technologies at our tissue pilot plant in Graz, Austria

WATCH THE VIDEO on our *PrimeLineTIAC*



### PRESS SECTION

The *PrimePress* XT Evo shoe press is loaded by two pressurized hoses, allowing a mill to fine-tune the nip profile for maximum dryness, or maximum bulk, or somewhere in-between. If the goal is high dryness, the *PrimePress* XT Evo offers about a 6% after-press dryness gain compared to a conventional suction roll – meaning thermal energy savings of up to 24%. If the goal is high bulk at a target same dryness, basis weight or fibers can be reduced up to 10% – reducing the corresponding CO<sub>2eq</sub> emissions.



### DRYING SECTION

The *PrimeDry* YES heat recovery steam generator system uses exhaust air from a gas-fired Yankee hood and condensate from the Yankee with a steam generator (heat exchanger) to produce 15% of the steam required for the Yankee, saving up to 5% in thermal energy consumption.

When installing a larger diameter *PrimeDry* Steel Yankee in combination with a steam-heated *PrimeDry* Hood, steam generated with biomass can be used in both systems resulting in a drying technology with zero CO<sub>2eq</sub> emissions.



### COGENERATION

Some tissue producers are considering on-site cogeneration of electricity, especially when there are no fossil-free sources for purchased electricity. ANDRITZ offers the option to use hot air from the turbine exhaust to heat the Yankee hood, allowing conventional hood burners to be switched off. The hot exhaust air can also be used to generate steam for the Yankee. With cogeneration in place, a mill can be self-sufficient from an electrical view and may be able to sell excess kW to the grid to generate revenue.



### HYDROGEN

Hydrogen (either purchased or produced on-site via electrolysis) can replace natural gas and significantly reduce CO<sub>2eq</sub> emissions. Hydrogen can be used to replace 100% of the fuel used to heat the Yankee hood while also partially replacing the fuel used in a cogeneration system.

Combustion of hydrogen provides a direct reduction of CO<sub>2eq</sub> and CO emissions by about 15%.



### TEXTURED TISSUE

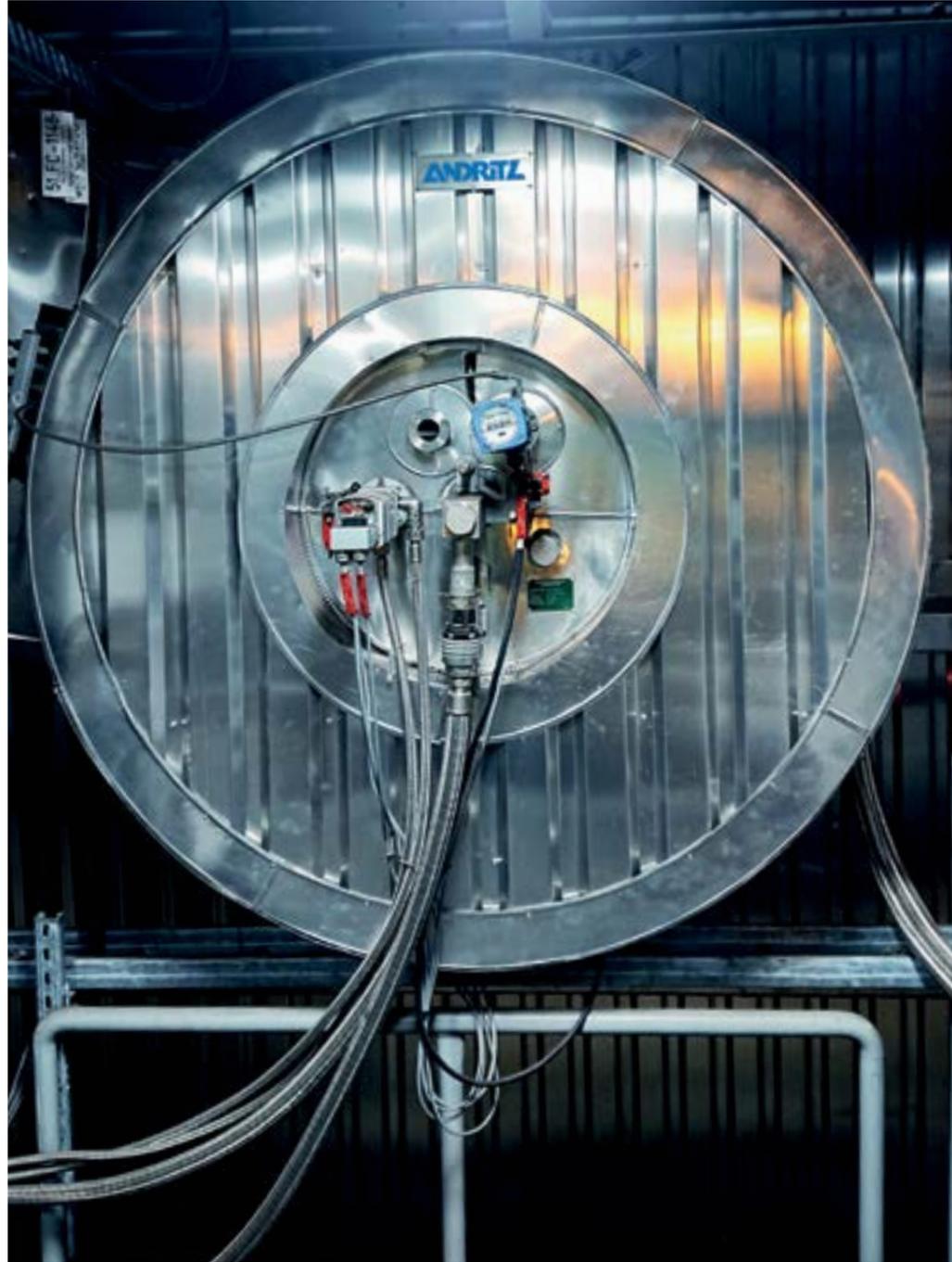
For mills located in regions where CO<sub>2eq</sub> emissions are restricted, but consumer interest in higher quality products is increasing, a new technology *PrimeLineTEX* machine may be worthy of consideration. The *PrimeLineTEX* produces a “textured” sheet with quality much better than dry-crepe and close to TAD. The required energy is slightly higher than for dry-crepe, but about one-half that of TAD. The higher quality of the TEX products, opens the possibility to substantially reduce (up to 30%) the fiber input compared to dry-crepe.



### TISSUE INNOVATION AND APPLICATION CENTER

The *PrimeLineTIAC* Tissue Innovation and Application Center comprises a complete, state-of-the-art tissue production line, including laboratory facilities for tests and trials to develop new products and processes in the tissue sector. The tissue machine offers utmost flexibility for the production of conventional, textured, and structured (TAD) tissue.

The *PrimeLineTIAC* is available to tissue producers and suppliers, research and development companies, and universities.



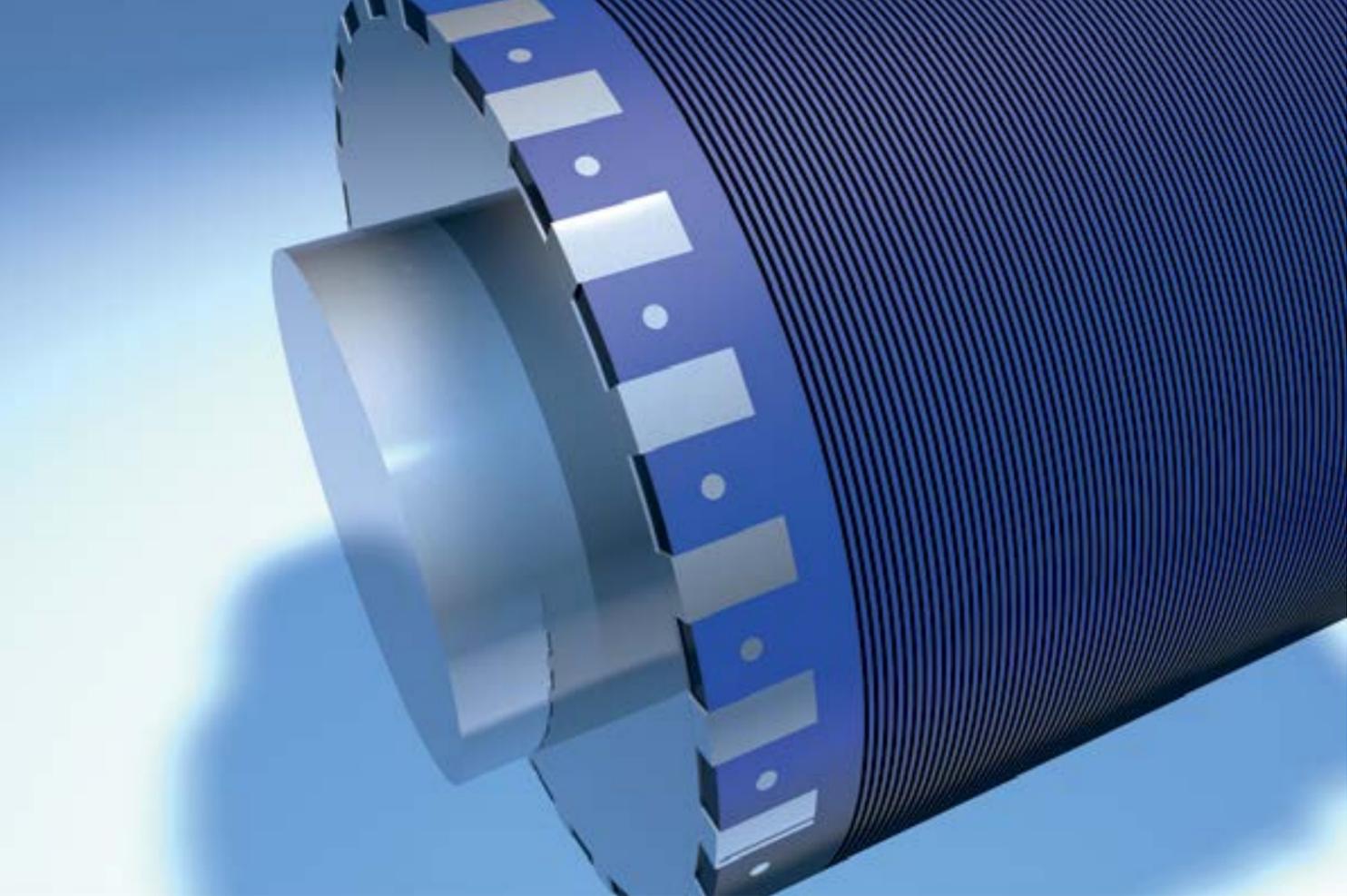
**ALTERNATIVE  
FUELS**

Biomass can be used to generate renewable bio-syngas to replace fossil fuels when firing the Yankee burners. Sofidel Kisa, Sweden, entered into a long-term collaboration with Meva Energy to build and operate a syngas generation plant, utilizing biomass as the feedstock. ANDRITZ burner solutions is supplying the syngas burners for the new project and is working in close collaboration with ANDRITZ Novimpianti and the Department of Energy of Pisa University to upgrade the existing Yankee hoods at Kisa.

**Up to 8,500 t/a  
less CO<sub>2</sub> emissions**

The use of fossil-free syngas from biomass gasification to feed the burners of the hoods (and boiler) in the drying section of the tissue plant allows CO<sub>2</sub> emissions to be reduced by 8,500 tons per year as compared to the carbon footprint generated by today's consumption of fossil LPG.





Impulse shoe press belt with grooved design

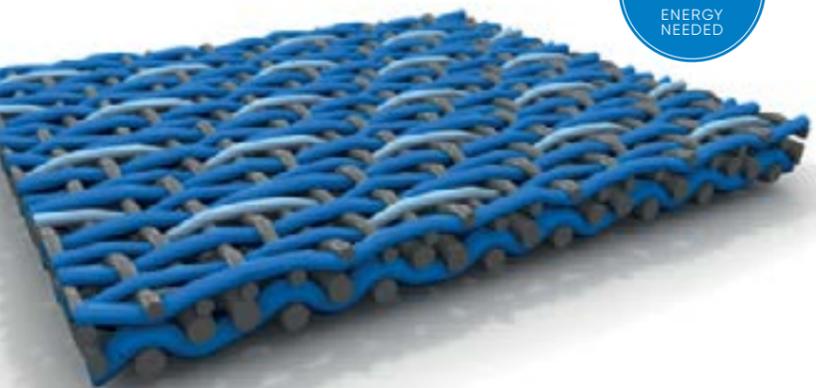
„Fabrics and rolls are often underestimated in terms of their potential for resource savings.“



**TRANSFORM SYNERGY PLUS**

TransForm Synergy Plus is a new generation of forming fabric technology combining innovative fabric structures with game-changing materials to delivering superior performance on your most demanding tissue machines. It enables fastest drainage with superior sheet quality at fast machine speeds, contributing to higher production rates with reduced energy consumption. The enhanced dimensional stability of TransForm Synergy Plus offers on top extended fabric life potentials.

**-10%**  
ENERGY NEEDED



**IMPULSE SHOE PRESS BELT AND PRESS FELTS**

The PrimePress XT Evo shoe press in combination with our Impulse shoe press belt and StrataPress T press felt design enables maximum post press consistency with lowest possible energy consumption. High pre-dewatering on the suction turning roll and a sufficient void volume in the nip is needed to avoid hydraulic overloading resulting in moisture profile issues. Therefore a tailor-made solution combining an optimized felt design with the best suitable shoe press belt material and surface design is the prerequisite to achieve the maximum result in terms of post press dryness content with low energy consumption for each application. The Impulse shoe press belt combines superb material and structural stability, with enhanced impact, tear and abrasion resistance. The superior material provides excellent chemical, oil, and hydrolysis resistance for longer service life.

**REBEL PRESSURE ROLL AND SUCTION PRESSURE ROLL COVER**

Installing the high-performance PU roll cover Rebel on a tissue suction roll with engineered surface venting instead of traditional rubber covers, leads to increased sheet dryness after press by 1% and more. This can be the starting-point for a machine speed increase or energy savings in the drying section between 50 and 100 kWh per ton of paper produced. Because of its low hysteresis and reduced internal temperature development, Rebel can run non-water-cooled on tissue pressure rolls.

This saves maintenance costs, raises roll reliability and offers energy savings of up to 25% of the initial roll driving power requirement. As a side-effect Rebel typically doubles the life-time of conventional rubber covers.

**-25%**  
ENERGY NEEDED

**RECYCLED PRESS FELTS IMPROVE CO<sub>2</sub> BALANCE**

The production of press felts for tissue machines generates considerable amounts of high-grade plastic as waste material. Valuable material that we can now recycle and return to the production of new felts. This improves the sustainability of our product - an advantage not only for the environment, but also for tissue producers interested in sustainability. For several months now, ANDRITZ has been producing press felts consisting partly of recycled material. It is now planned to increase the recycled content in certain parts of the press felt and extend the recycling activities to other sections of paper machine clothing. With our recycling projects, we are closing the loop a little further and thus helping to reduce the CO<sub>2</sub> emissions generated in the production of new plastics.

# Automation and digitalization

Any tissue mill can benefit from digitalization to improve efficiencies and repeatability. Digital solutions such as ANDRITZ Metris are well suited to optimize production while minimizing a tissue mill's total GHG emissions.



Digital solutions offer a high potential for optimization of tissue production and reduction of emissions.

**GET AN OVERVIEW**  
on all Automation and  
Digitalization solutions for Tissue



## METRIS APC

Since there are very few integrated tissue mills existing today that have access to steam generated by non-fossil fuel sources such as black liquor or wood waste boilers, the Metris APC Tissue Energy Balance solution is beneficial in minimizing steam and electricity requirements.

The result is a lower demand on the mill's main steam requirements, allowing for a reduction in fossil fuel usage (and the corresponding reduction in GHG emissions).

Other Metris solutions include advanced dryer controls to save considerable energy with excellent payback. Metris APC solutions enhance the standard regulatory or DCS-level controls found in a typical mill and are specifically focused on optimization of throughput, quality, and cost.

## ARTIFICIAL INTELLIGENCE

A major advantage to tissue producers is the use of integrated Artificial Intelligence (AI) and Machine Learning (ML) in these digital systems which can learn the decisions taken from the very best operators to avoid sheet breaks and other downtime.

These systems also optimize start-up and shutdown sequences to minimize waste or disruptions and can handle changing conditions and adjust accordingly.

## METRIS DCS

Metris DCS is a hardware-independent automation solution for the process industry. In addition to the classic control tasks, Metris DCS

also has directly integrated artificial intelligence functions. Metris DCS is ideally suited for the realization of automation solutions - from a single machine to the complete plants. Also an upgrade of existing systems while retaining existing components and cabling can be realized with Metris DCS solutions.

## METRIS RISK-BASED MANAGEMENT

It is now state-of-the-art that single assets or devices can self-diagnose well, utilizing AI methods and also predict their impending problems. The Metris risk-based management approach goes much further. For the state of health of individual process areas,

it will automatically calculate the technical production risk, which can be very high for single units, but low for redundant concepts.

To the conditions of the individual assets, supplemented by their criticality, the compliance with the prescribed maintenance measures is added on top. The result shows a precise picture of all assets and equipment with a complete risk analysis covering the whole factory.

**WATCH THE VIDEO**  
on Metris risk-based  
management

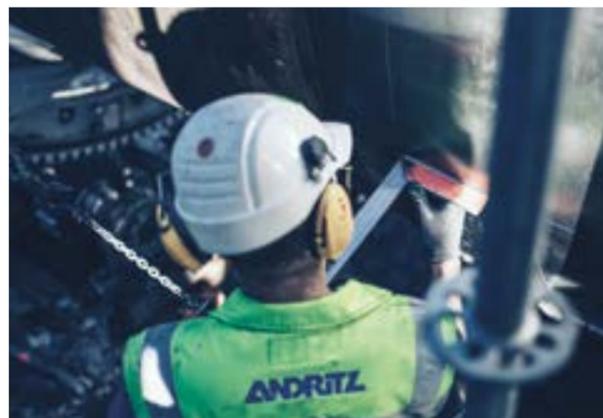


# Sustainable services and pumps for tissue machines that extend lifetime

ANDRITZ supplies spare parts and engineered wear products and provides customer-specific maintenance and upgrade services for your tissue mill.

Our tissue machine service specialists are skilled and experienced at raising the production efficiency of a machine, sub-process, or production line. Their knowledge helps protect and extend the lifetime of your equipment and lower the overall operating costs.

The variety of ANDRITZ upgrade products provides performance improvements, energy and cost savings as well as return on investment (ROI) within a very short time. We work closely with you to monitor, maintain, repair, and upgrade your assets. Full support – technically, mechanically, and personally – is provided regardless of who originally manufactured your equipment.



## SERVICE PRODUCT PORTFOLIO

- Headbox overhaul
- Yankee service
- Ceramics
- CD control actuators
- Roll service
- Threading systems
- High-pressure nozzle systems
- Turn-up systems

## YANKEE SERVICE | SEEING THE FULL PICTURE WITH LIFE CYCLE MANAGEMENT

A well-maintained Yankee offers high potential for improved runability and efficient production – a remarkable competitive advantage for the customer. With our Yankee life cycle management, we focus on the overall added value for Yankees: from calculation, to manufacturing, coating (PrimeCoat Stratos), operation, and optimization. We are one of the few suppliers able to offer customers a life time forecast for their Yankees. This is possible due to our experience in Yankee development and manufacturing work at ANDRITZ.



## SMART PUMP SOLUTIONS

ANDRITZ offers the complete pump portfolio for tissue lines. In particular, our centrifugal pumps of the ACP series are used as process pumps in many different areas. Thanks to the wear-resistant and robust design, a long service life is ensured. Depending on the impeller design, even heavily contaminated media with a high solids content or with a consistency of up to 8% can be pumped. With the best possible NPSH values, lowest pulsation and efficiencies of up to 90%, these reliable pumps are an important part of the overall energy efficiency of a tissue plant. Due to the modular design, the motor size can be easily changed and thus adapted to changing circumstances. There is also a special design feature for high gas content in the pumped medium.

The ANDRITZ SMARTSEP degassing system was specially developed for high gas contents and stock suspensions of up to 8%. An additional separation impeller acting as an integrated degassing system removes gas from the media and conveys fibres reliably back to the pump at the same time. Thus, no additional vacuum pump is needed.

In terms of sustainability it is important to monitor the performance of the pumps and intervene as soon as it is necessary. This is why ANDRITZ has developed a state-of-the-art digital solution for real-time communication with your pumps, the Metris PumpKit. A reliable way to collect and evaluate your data, the PumpKit is a configurable monitoring system with an independent dashboard that is easy to install in a wide range of setups. It automatically analyses large volumes of data and provides clear evaluations and recommendations

for action. This allows to detect any signs of damage early on and schedule the necessary pump maintenance. It also enables you to identify poor operating conditions by means of the sensors installed in combination with the evaluation logarithm, and you receive warnings and service requests under certain conditions.

What's more, the Metris PumpKit detects potential for reducing power consumption, resulting in better energy efficiency for your plant along with cost savings and a lower carbon footprint.

## SERVICE NEWS BONETTI NOW PART OF ANDRITZ

ANDRITZ acquired Bonetti. Established in 1923, Bonetti is a global manufacturer and supplier of doctor, creping and coater blades, blade holders, doctoring/creping systems and also provides services.

This acquisition extends and strengthens ANDRITZ's aftermarket business and supplements the company's current Paper Machine Service portfolio.

## SPOTLIGHT ON CREPING COATED-TIP CREPING BLADES

One of Bonetti's unique solutions for the tissue industry are coated-tip creping blades. Stable creping quality due to the slow wear of the blade contact area, better softness and lower dust levels than with conventional blades, reduced breaks and less blade vibrations are only some of their key benefits for tissue producers.



ANDRITZ Bonetti creping doctor on Yankee



## DISCOVER OUR FULL-RANGE PORTFOLIO FROM FIBER PROCESSING TO PAPERMAKING

An outstanding paper product requires outstanding production – matched with the particular needs of raw material and final product. Discover the full-range portfolio from ANDRITZ: Excellent stock preparation that allows best fiber development according to furnish and with economical use of resources. *PrimeLine* paper machines that are a synonym for producing top-quality tissue, paper, and board grades. Complete lines or single units, upgrades, and modernizations. Contact us and benefit from your individual package in papermaking technology.

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**GET AN OVERVIEW**  
on our sustainable tissue  
technologies and services



# ANDRITZ

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