WOOD-BASED SOLUTIONS **FROM FINLAND**

THE FINNISH FOREST INDUSTRY BUILDS FUTURE GROWTH AND SUSTAINABLE WELFARE

#FINLANDWORKS

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RENEWABLE BIOPRODUCTS **OVERVIEW**

THE GLOBAL MARKETS FOR FOREST INDUSTRY PRODUCTS ARE EXPANDING. THE GROWTH IS INCREASINGLY DRIVEN BY NEW PRODUCTS

EUR 575 BILLION

2017

+90

- Population growth
- Urbanization
- Construction
- Industrialization and automation
- Furniture industry
- Health effects
- Carbon balance

+56

- Globalization and urbanization
- Smaller households
- E-commerce
- Labeling and product requirements
- Replacement of plastic packaging
- Take-away culture

-1

- Exponential growth of e-communication
- Change in reading habits
- Electronic archiving and documentation solutions

WOOD PRODUCTS

FIBRE PACKAGING

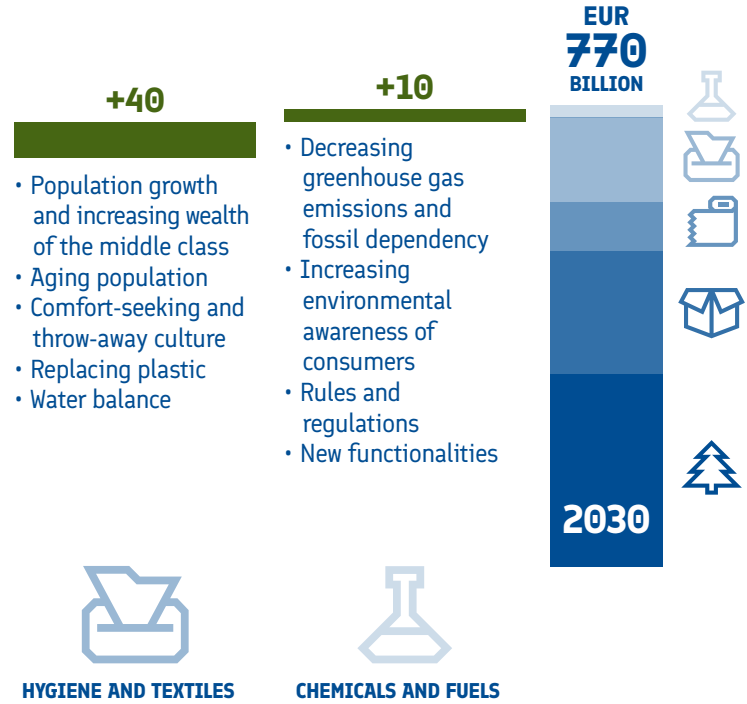
PAPER

Source: Pöyry/The global markets and growth potential for forest industry producs in 2030 - a 2018 report

Renewable raw materials are the future. Throughout the world, our lifestyles and consumption patterns are in urgent need of change. Wood-based solutions offer climate-friendly options. Global markets for bio-based products are projected to grow by a whopping EUR 200 billion by 2030.

The winners in tomorrow's sustainable economy will be wood-based products, ranging from microscopic nanocellulose to massive construction elements. In the carbon-neutral future, we will dress in wood-fibre-derived textiles, eat and drink from fossil-free containers and power our vehicles with bio-based fuels and biocarbon-based batteries.

Wood-based raw materials and intermediate products will be used in the cosmetics, chemical, pharmaceutical, electronics, food and energy industries to deliver on their own climate objectives.



TOMORROW IS MADE OF WOOD

WOOD-BASED INNOVATIONS FROM FINNISH FORESTS REDUCE THE NEED FOR FOSSIL-BASED PRODUCTS AND MATERIALS

Finland is set to be carbon-neutral by 2035. This requires faster emissions reductions in all sectors and the use of increasingly more forest resources. The role of the forest industry will continue to grow in importance.

The carbon storage created by Finnish forests is increasing. The volume of growing stock in Finnish forests has risen rapidly since the 1970s. According to the scenario laid out by the Natural Resources Institute of Finland (LUKE) and commissioned by the forest industry, this growth can be sustained with increased harvesting.

In Finland, forest owners are required by law to take care of forest regeneration after harvesting.

More than half of Europe's strictly protected forests are in Finland. The positive outlook for the Finnish wood processing industry has motivated forest owners to look after the wellbeing of their forests.

Active and sustainable forest management is good for the climate. While a tree grows, it captures carbon from the atmosphere. Wood-based products offer great climate-friendly options.

Fossil raw materials belong to the past and renewable raw materials to the future.

IN A CLIMATE-NEUTRAL SOCIETY, A TREE IS THE KEY RENEWABLE SOURCE FOR BIO-BASED RAW MATERIALS AND PRODUCTS

COSMETICS

FOOD MATERIALS

BIOCARBON

HEAT

HYGIENE PRODUCTS

FILMS AND BARRIERS

ADHESIVES

DETERGENTS AND DISINFECTANTS

PACKAGING SOLUTIONS

PAPER

CELLULOSE

TEXTILES

COMPOSITES

BIOCHEMICALS

BIOFUELS

BIOMEDICALS

CONSTRUCTION AND CARPETING MATERIALS

CLIMATE BENEFITS CREATED BY THE FOREST INDUSTRY ARE INCREASING.

FOSSIL FUEL-FREE MILLS ARE REALISTIC

- By 2035, forest industry mills in Finland will be nearly fossil fuel-free, and from then onward, even carbon negative
- 87% of the fuels used in the Finnish forest industry today are renewable
- Fossil-fuel CO_2 emissions relative to forest industry production have fallen by 64% since 1990

WOOD-BASED PRODUCTS REPLACE PRODUCTS MADE OF MATERIALS THAT CAUSE MORE FOSSIL EMISSIONS

- Products from Finnish grown woods replace products made of non-renewable raw materials with over 16 million equivalent CO_2 tons abated per year
- This is more than one-third of all current CO_2 emissions of Finland and about five times the emissions of the forest industry mills at the moment (3 Mt CO_2)

ACTIVE MANAGEMENT INCREASES CARBON STORAGE OF THE GROWING STOCKS

- Active management supports the growth and viability of forests and hence is a part of cost-effective and rational climate policy

20%

WITH A 20% SHARE OF THE VALUE OF THE EXPORTED GOODS, THE FOREST INDUSTRY IS FINLAND'S KEY EXPORT SECTOR

4

IN FINNISH REGENERATION FELLING, FOUR NEW TREE SEEDLINGS ARE PLANTED FOR EVERY TREE HARVESTED

60%

60% OF FINNISH FORESTS ARE OWNED BY ORDINARY FAMILIES WHO PRODUCE OVER 80% OF THE WOOD USED BY THE FOREST INDUSTRY

90%

OVER 90% OF FINNISH COMMERCIAL FORESTS ARE CERTIFIED UNDER A PEFC- OR AN FSC-ENDORSED SCHEME

HOME OF BIO-BASED **INNOVATIONS**

FINLAND HAS WORLD-CLASS KNOW-HOW IN INNOVATIVE BIO-BASED PRODUCTS AND TECHNOLOGIES, OFFERING ATTRACTIVE INVESTMENT OPPORTUNITIES

FINNISH STRENGTHS

- Extensive experience and competence in sustainable forest management
- Extensive forest resource information produced by national forest inventories, including unique decades-long time series
- Established collaboration models in research, development and innovation (RDI) between academia and industry, covering the whole sector from forest to fractionation and novel products from biomass
- A fully digitized value chain including virtual reality-based forest management, predictive production process optimization for raw material efficiency and IoT-connected products
- World-leading education and research in forest-based industries
- Frontrunner companies with strong knowledge in the forest-based industries
- Vibrant new businesses based on renewable raw material and circular business models
- Expertise in wood pulp fibre structure, properties, separation and modification
- Expertise in the paper and packaging value chain and recyclability
- Excellent piloting opportunities for new fibre-based processes and products

WORLD-CLASS **RESEARCH**

FINNISH RESEARCH REPRESENTS THE CUTTING EDGE OF GLOBAL BIOPRODUCTS, LEADING THE WAY TO A CARBON-NEUTRAL FUTURE

BOOSTING SUSTAINABLE INNOVATIONS

Aalto University
School of Chemical
Engineering

FinnCERES
Materials Cluster

AALTO UNIVERSITY focuses on products derived from renewable sources through green chemistry and biotechnological methods. Our core competencies include the chemistry and applications of lignocellulosic materials, fractionation of biomass, downstream unit operations and advanced characterization of materials.

THE NEW ERA OF SUSTAINABLE TEXTILE PRODUCTION

Aalto University's innovative Ioncell® technology turns used textiles, pulp or even old newspapers into textile fibres sustainably and without harmful chemicals. The process converts cellulose into fibres which can be made into long-lasting fabrics. We are planning to open a pilot plant where textiles can be produced and tested by customers.

REDEFINING BIOECONOMY WITH ADVANCED BIO-BASED MATERIALS

FinnCERES is a global competence center in the area of materials bioeconomy, formed jointly by Aalto University and VTT Technical Research Centre of Finland. FinnCERES uncovers answers to fundamental questions about lignocellulose disassembly and reassembly to create cost-competitive, bio-based materials for a sustainable future.

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PLASTIC-LIKE PACKAGING FROM RENEWABLE RAW MATERIALS

VTT has developed a material made of cellulose and fatty acids which, due to its thermoformable properties, can be used in food packaging in a similar manner to plastic. This Thermocell material can be refined into films and bulk commodities and processed in conventional plastic treatment processes.

THIN, DURABLE, PROTECTIVE AND SAFE

Food packaging favors films that are as thin and durable as possible, but yet protect foods safely. Thermocell has already been shown to provide good protection against water vapor, and none of its components migrates into the food. Thermocell film can also be heat sealed using the manufacturers' standard equipment.

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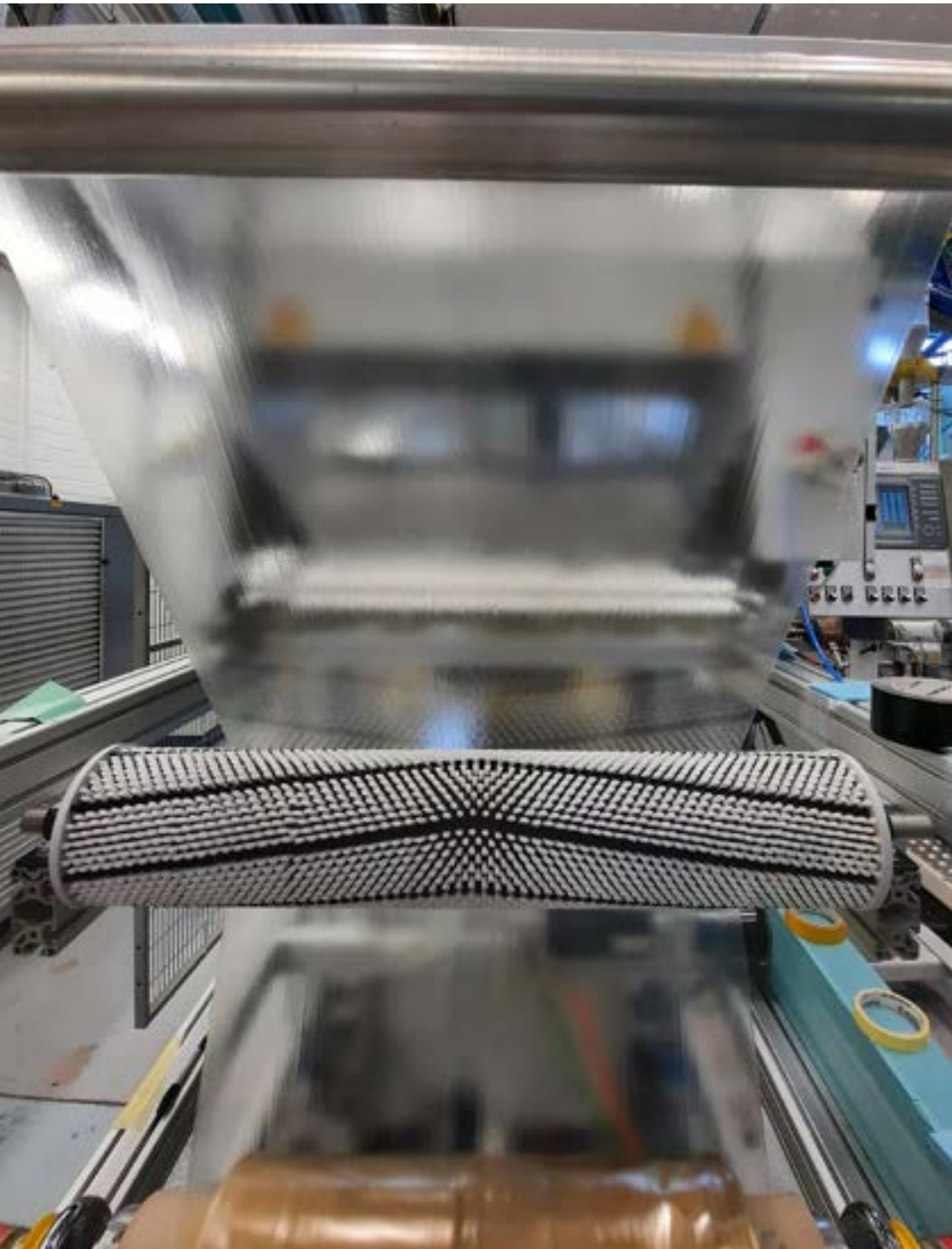

BIOMASS FRACTIONATION AND MODIFICATION TECHNOLOGY

Åbo Akademi University

ÅBO AKADEMI UNIVERSITY'S bio-refining approach aims at utilizing forest and other renewable resources as extensively as possible. For example, selective extraction and recovery of hemicelluloses, cellulose and lignin, along with polyphenols from wood, bark and process waters, are followed by functionalization to serve different value-added end uses.

BIOPOLYMERS FOR MEDICAL TREATMENT

We have explored the potential of nanocellulose, hemicelluloses and lignin for hydrogels and materials in biomedical applications, especially through 3D bioprinting. Several approaches have been developed to combine nanocellulose with cross-linkable hemicellulose derivatives to formulate bioinks for uses such as in human spare parts.

SURFACE ENGINEERING OF NATURAL FIBRE-BASED MATERIALS

This competence area extends from traditional mineral pigment coating to printing and novel surface treatment methods for the fabrication of functional coatings and printed electronics on paper. Our recent work has developed high throughput coating processes for nanocellulose to be used as biodegradable barrier coatings and films in packaging applications.

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SUSTAINABLE GROWTH IN BIOECONOMY

CLIC INNOVATION LTD is a non-profit company based on the public-private partnership (PPP) model. We manage research and innovation collaboration between companies and academia. CLIC creates additional value by building, coordinating and managing collaborative research, development and innovation (RDI) projects to construct systemic solutions, which are beyond the resources of individual operators.

ADDED-VALUE MATERIALS AND CHEMICALS FROM WOOD FIBRES

CLIC's bioeconomy focus is on developing novel added-value materials and chemicals from wood fibres especially in four application areas:

- **High-performance fibres** – covers a wide range of technologies and processes which transform raw materials from the forest into high-added-value fibres for different end applications.
- **Packaging materials** – increases the use of bio-based raw materials and aims at creating innovative packaging materials with new properties.
- **Biocomposites** – aims at enabling biocomposites to become a compelling material alternative by developing new, high-performing natural fibre composites.
- **Bio-based chemicals** – targets reduced dependency on fossil-based raw materials by developing high-performance, sustainable wood-based biopolymers and biochemicals.

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BIOECONOMY INNOVATIONS **FROM FINLAND**

FINLAND OFFERS WORLD-CLASS BIOECONOMY EXPERTISE FOR THE FUTURE OF THE WHOLE WORLD

UPM Formi 3D

RENEWABLE AND RECYCLABLE PACKAGING SOLUTIONS

PACKAGING LAMINATES, MATERIALS AND SOLUTIONS

SUSTAINABLE HIGH-PERFORMANCE PAPERBOARDS

METSÄ GROUP'S Metsä Board provides paperboards designed specifically to help brand owners and packaging converters tackle the big issues in packaging – saving resources, reducing carbon footprint, ensuring product safety and increasing brand appeal.

We are a forerunner in lightweight folding boxboards, food service boards and white kraftliners. Lightweight paperboards maximize material efficiency and reduce the carbon footprint of packaging. Our paperboards are the choice of leading brands in packaging consumer goods along with retail-ready and food service applications.

PACKAGING SOLUTIONS THAT RESPECT NATURE

Our fresh fibre paperboards are made of renewable and recyclable wood fibre traceable to sustainably managed forests. They are available with either PEFC™ or with FSC® certification. Mitigating climate change and working toward 100% fossil-free mills by 2030 are at the core of our sustainability targets.

Thanks to our tailor-made pulps, our paperboards provide high-converting performance and visual properties. They enable demanding printing, finishing techniques and graphical applications for food, beauty care, healthcare and luxury packaging.To complement our paperboards, we offer expert services to enhance our customers' performance in printing and converting, packaging design, R&D, sustainability and supply chain optimization.

Our Excellence Centre offers tools and concepts for working together with our customers to innovate new packaging solutions. We participate in long-term R&D programs – such as the ExpandFibre collaboration – to create novel bioproducts.

100% FOCUS ON SAFETY AND SUSTAINABILITY

Metsä Board is a leading European producer of premium paperboards. We are the #1 supplier of folding boxboards and white kraftliners in Europe as well as a leader in coated white kraftliners globally. Our mills are located in Finland and Sweden. Our products are sold worldwide.

COMMITMENTS AND ACKNOWLEDGEMENTS

- Science Based Targets Initiative's Business Ambition for 1.5 °C
- UN Global Compact initiative
- EcoVadis Platinum rating for sustainability and corporate social responsibility
- CDP Climate A and Water A list positions and A- in CDP's forest program
- MSCI ESG Rating AAA

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INNOVATING ECO-FRIENDLY SOLUTIONS

STORA ENSO is a leading global provider of renewable solutions in packaging, biomaterials, wooden construction and paper. We believe that everything that is made with fossil-based materials today can be made from a tree tomorrow.

PLASTIC-FREE PACKAGING FOR THE CIRCULAR ECONOMY

Stora Enso's products are replacing plastics in food packaging, in natural cosmetics and personal care, as well as in e-commerce. Stora Enso's Packaging Materials division aims to be a global leader in the circular economy by offering high-quality renewable packaging materials based on both virgin and recycled fibre. Stora Enso holds leading market positions in various packaging businesses.

Addressing the needs of today's eco-conscious consumers, Stora Enso helps customers and brand owners find the best material for their packaging and replace fossil-based materials with low carbon footprint, renewable and recyclable alternatives. A wide selection of barrier coatings enables the design and optimization of packaging for various demanding consumer and industrial packaging end uses.

SUSTAINABLE PACKAGING INNOVATIONS

Stora Enso's innovation focus areas include sustainable packaging applications to replace fossil-based materials. PureFiber™ by Stora Enso is a new range of plastic- and fluorochemical-free formed fibre packages suitable for food service products and consumer goods.

Bio-based foam replaces oil-based polymer foams and can be used as protective packaging and cushioning for fragile products such as consumer electronics.

Stora Enso develops eco-friendly barriers for food service applications. Protective barriers are required in packaging for certain food or beverage products to protect against liquid, moisture, oxygen or fat.

FOR THE GROWING PACKAGING MARKETS

Stora Enso is converting its Oulu paper mill in Finland to produce kraftliner for packaging. This move will further improve the company's position in the growing packaging business. The mill started production in mid-January 2021. Stora Enso has also one of the world's largest liquid packaging board production facilities in Imatra, Finland.

Part of the bioeconomy, Stora Enso is a leading global provider of renewable solutions in packaging, biomaterials, wooden construction and paper. We employ some 23, 000 people and have sales in more than 50 countries. Our shares are listed on the Helsinki (STEAV, STERV) and Stockholm (STE A, STE R) stock exchanges.

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RENEWABLE PLASTIC FROM THE FOREST

UPM BIOFORE BEYOND FOSSILS

UPM RAFLATAC Forest Film™ is the world's first renewable plastic label material. It is based on UPM BioVerno naphtha, a 100% wood-based solution from crude tall oil which is a residue from the pulping process. This first-of-its-kind material brings UPM Raflatac's vision of "labeling a smarter future beyond fossils" to life and answers the needs of customers to replace traditional fossil-based virgin materials with renewable ones.

Forest Film offers companies an efficient and impactful way to reach and surpass their sustainability goals without compromising product performance. It has the identical performance to traditional plastic film label materials. Forest Film is available as either polypropylene or polyethylene, in both clear and white films for several packaging end uses.

The Forest Film product range has an International Sustainability & Carbon Certification (ISCC PLUS). It is produced using sustainable biofeedstock that replaces the equivalent amount of fossil resources used in the production process. The amount of sustainable resources is accounted for by applying a mass balance approach.

AWARD-WINNING INNOVATION

The Forest Film label material has been recognized with multiple awards around the world. Recently, the Forest Film PP label material won Silver at the 2020 Packaging Innovation Awards sponsored by Dow. UPM Raflatac has also partnered with Vellamo, Finland's award-winning natural mineral water. The Forest Film label material can now be found on Vellamo's bottles.

ABOUT UPM RAFLATAC

UPM Raflatac leads in sustainable labeling through our innovative self-adhesive label materials and services. We offer high-quality paper and film label stock for branding and promotion, informational labels and labels with functionality.
We operate a global network of factories, distribution terminals and sales offices. Our company employs around 3,000 people and made sales of EUR 1.6 billion (USD 1.8 billion) in 2020. UPM Raflatac is part of UPM. Find out how we are labeling a smarter future beyond fossils at www.upmraflatac.com.

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TOWARD A PLASTIC-FREE FUTURE

KOTKAMILLS' sustainable, fully recyclable packaging materials – AEGLE® folding boxboards and ISLA® food service boards – are replacing plastics. People want to continue their fast-paced lifestyles without creating unsolvable waste problems. They value recyclability and want to avoid unnecessary plastic. Our passion is to enable both convenience and conscious choices for food packaging. We use, explore and develop the power of wood for new sustainable packaging solutions. Our aim is plastic-free convenience. We partner with others to accelerate circularity.

RENEWABLE, RECYCLABLE AND REPULPABLE PRODUCTS

Kotkamills' renewable, recyclable and repulpable packaging boards are food safe and resource efficient. This is achieved by using virgin fibre of northern origin along with the side streams of sawmilling. Moisture and grease resistance is created on the board machine, online, with water-based dispersion technology. Because of excellent barrier properties, these boards are used as material for food packages and food service applications globally.

Unlike conventional plastic-lined products, the cups, plates and other packaging made of these materials can be easily recycled with other paper or board materials after their use. No separation of plastic is needed. The wood fibre can be reused several times, depending on the upcycling applications.

COLLABORATION IS KEY

Kotkamills successfully launched the sustainability of these boards and has perfected the circularity with the valuable collaboration of its customers as well as other stakeholders. Through joint innovation projects, new solutions have been developed to meet customer needs and fulfill the requirements of effective recycling

as well as other value-gaining targets of the circular economy.
Kotkamills participates in several international organizations, alliances and initiatives to foster the circularity of materials. 4evergreen, NextGen Cup Challenge, SITRA and the EU WoodCircus project are some of our references.

ABOUT KOTKAMILLS

Kotkamills is an experienced and responsible global partner, manufacturing innovative products created from wood and other renewable natural resources. Our range of sustainable products includes food-safe consumer boards, the high-quality saturating base kraft paper Absorbex® and ecological wood products. All our products are environmentally friendly, recyclable and safe to use.

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A LEADING SUPPLIER OF SPECIAL CARTONBOARDS

PANKABOARD, a leading supplier of special cartonboards, is known for its high-quality products, flexible operating model and skilled personnel.

The product offering features high-quality cartonboards for various packaging requirements, including folding cartons, rigid packaging as well as elements in other packaging solutions. Through its own sales offices and a wide sales network, Pankaboard operates globally.

COMBINING LIGHTNESS WITH PURITY

Pankaboard is the frontrunner in high-thickness folding boxboards and uncoated specialty cartonboards. The flexible operating model, unique asset capabilities and continuous product development efforts make Pankaboard a truly distinctive cartonboard supplier.

Pankaboard offers material solutions for a variety of printed packaging as well as materials for capseal production, structural elements for food underlays and tray applications. Lightness in combination with purity creates unique alternatives to fossil fuel-based materials. The materials are approved for food contact.

All cartonboards are made from fresh fibre to ensure the highest purity and lightness. Our integrated groundwood plant is efficiently operated, utilizing local spruce for fibre production. All of our products are naturally recyclable and made from renewable sources.

MINIMAL ENVIRONMENTAL IMPACT

Through sustainable local wood sourcing in northern Karelia and efficient operations in combination with our integrated biofuel steam plant, Pankaboard's environmental impact has been reduced to a minimum.

With an exceptional range of products, tailored service and innovative spirit, Pankaboard provides customers with sustainable solutions for unique converting and end-use requirements.

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INNOVATIVE CIRCULAR PACKAGING MATERIALS

WALKI is eager to support the transition away from aluminum and plastic-based solutions toward fibre-based alternatives. That's why Walki developed an ovenable tray made of renewable fibre.
The Walki®Pack Tray is 100% PET-free and easy to recycle.

The tray can stay in the oven for up to 60 minutes. The trays are also suitable for a wide variety of applications, including frozen or chilled ready-made meals such as fish and baked goods. The Walki®Pack Tray solution can be used for folded and pressed trays. These are easily recyclable, as barrier materials have been kept to a minimum.

We are continuously working to increase the fibre content of our products. Now with the launch of this new tray material, we have taken a giant step toward mono-material solutions.

A PAPER POUCH TO REPLACE PLASTIC POUCHES

Pouches made of paper and Walki®Wood material are a 100% wood-based barrier packaging that is accepted as paper in the local collection streams in several countries.

Walki's pouch material is made of 100% renewable raw materials, including tall oil-based polymers for the barrier and heat sealing with a significantly lower CO_2 footprint compared to traditional plastic pouch materials.

The new pouch material is compatible with existing packaging lines. It is suitable for packing many different dry ingredients, such as snacks and nuts, bakery products or even frozen products.

ABOUT WALKI

At Walki, we believe in a sustainable and circular tomorrow. Our mission is to accelerate the world's transition to a zero-waste future in packaging and to promote the use of energy-efficient materials across industries. From sustainable materials for packaging applications to energy-saving performance materials, Walki's solutions are designed to bring value to customers in many different markets.

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NEXT-GENERATION PACKAGING MATERIAL

PAPTIC®

PAPTIC® is the new bio-based, recyclable, reusable and biodegradable next-generation packaging material made of renewable raw materials. Forging a category of its own, Paptic® combines the best features of existing materials, including paper-like high print quality, non-woven durability and textile versatility.

Wood-based Paptic® is an environmentally friendly and resource-efficient material. It is safe to use in everyday operations. Our team is committed to reducing our environmental footprint through an active and responsible approach to designing and manufacturing our sustainable products.

SUSTAINABLE PACKAGING WITH PAPTIC®

Single-use plastic in packaging has a high possibility of ending up as trash on land or in the oceans. Multi-purpose products are a sustainable choice if they are recyclable, reused, and made of renewable materials. Products made of Paptic® are all this.

Packaging made of Paptic® can be used more than once – even more than ten times – as the material is strong, folds nicely and does not tear easily. Attractive designs combined with reusable Paptic® material expand brand visibility. For example, when used as bags, the brand's image as a company that respects nature is reinforced.

ABOUT PAPTIC

Established in 2015, Paptic Ltd is a high-growth company. Its fibre-based Paptic® material has been available on an industrial scale since 2018. Today, we've grown to 30 professionals, and our materials are delivered to over 30 countries.

ACKNOWLEDGEMENTS

- Stockmann starts to use Paptic® in their carrier bags and mailers in 2020
- Fazer's Moomin chocolate drops are packed in Paptic® in 2020
- A fibre-based e-commerce packaging by Paptic® wins ScanStar 2020 and WorldStar 2021 Awards
- Sokos replaces plastic with Paptic® in their carrier bags in 2019
- Paptic® receives the Solar Impulse Efficient Solution Label in 2019

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SUSTAINABLE PACKAGING SOLUTIONS

PYROLL Packaging provides comprehensive customer solutions for packaging and packaging materials – from designing and co-creating of packaging concepts to manufacturing and supplying of ready-to-use packaging materials, regardless of the raw material base used.

We service the food and retail industry with an extensive range of conventional high-performance, bio-based-fibre packaging solutions that are unique, sustainable and flexible – and ready for recycling!

ONE OF THE NORDIC'S LARGEST SELECTIONS

Customers from bakery and milling, dairy, meat-fish-chicken, chocolate and confectionary, ready food, fast food and food service industries are building their packaging activities based on our expertise and service.

Our packaging solution selection is one of the largest in the Nordics. Our unique technology expertise ranges from offset and flexo to digital printing. We are also one of the industry forerunners in multi-material color management. Today, we provide service from 10 food safety managed factories in Finland.

SMART AND SUSTAINABLE

Our innovations do more with less. We already provide eco-friendly packaging material solutions and make new solutions available. As a result of our development work, our own packaging material FlowPap® Evo was introduced. We also supply plastic-free grease- and moisture-resistant carton packages that are easily recyclable. FormPap is an excellent packaging material for sliced food products and reduces plastic usage by up to 85% compared to traditional materials. Fibre lids are the new lidding material without aluminum or metallic layers. They consist predominantly of renewable paper.

ABOUT PYROLL GROUP

Pyroll Group has its roots firmly in Finland and is one of the leading paper and paperboard converters in the Nordic countries. The group has three lines of business: Pyroll Packaging, Pyroll Paper Merchant and Pyroll Converting. Pyroll Group is a family-owned group that employs 600 people and has a turnover of about EUR 110 million.

Sustainability is in our DNA!

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SUSTAINABLE AND FLEXIBLE PACKAGING

WIPAK is a leading producer of multilayer films for the food and medical industries. The better products are protected, or the longer they can be stored, the more effectively resources can be preserved. Reduced material consumption, recyclable solutions, recycled or renewable-based materials are the basis for Wipak's development of sustainable packaging concepts.

COMMITTED TO ZERO EMISSIONS

Reduced material use and waste prevention are the foundation of Wipak's solutions. By selecting the most appropriate mixture of materials, Wipak develops the best possible packaging solution for minimum environmental impact.

In addition to material reduction, our focus is on recycling and renewable materials. The EU has the goal that 100% of plastic packaging be reused or recycled by 2030. Wipak has developed several PE- or PP-based mono-materials that are already recyclable.

SUSTAINABLE RAW MATERIALS

In the future, the use of post-consumer recycled material will be required by law. So far, these laws for food applications are limited to certain materials, such as PET. Wipak's MP-R is a semi-rigid bottom film made of the highest quality recycled PET granulate supplied by a world-leading bottle recycling scheme in Finland. These APET/PE bottom films contain 80% recycled material.

To sustainably expand the raw material base, Wipak has also introduced alternatives to crude oil-based materials. Our focus is on renewable resources that do not compete with food applications. Wipak uses FSC®-certified paper as an alternative printing substrate. All fibres come from responsibly managed forests and are free of mineral oils. Many Wipak plants are FSC® CoC certified, allowing for a closed and certified supply chain.

ABOUT WIPAK

Wipak is part of the family-owned Wihuri Group, a diverse Finnish conglomerate. Wihuri employs 5,000 people with operations in 30 countries. Wihuri's packaging business – Wipak in Europe and Asia and Winpak in North America – is one of the world's leading producers of packaging solutions for the food and medical industries.

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RENEWABLE AND RECYCLABLE PACKAGING SOLUTIONS

INNOVATIVE PACKAGING

Image courtesy of Sulapac

INNOVATIVE BEVERAGE PACKAGING

NWB FINLAND'S new packaging concept, NWB Bevel, is recyclable, user friendly and logistically efficient. NWB packaging has a unique design and shape. It builds on the bag-in-box principle consisting of two parts only: an outer corrugated box and a flexible bag with a dispenser. The box protects the liquid product from direct sunlight, giving it an extended shelf life, and the bag and dispensing tap ensure minimal contact of the liquid with air even after opening.

Due to its unique modular design with matching 2-pack units, it is stackable. It fits the euro-pallet perfectly, cutting costs in logistics. All NWB Bevel package sizes also fit easily into the fridge, keeping the liquid cooler and easy to use straight off the shelf.

NWB INNOPAL – ECO-FRIENDLY PALLET SYSTEM

NWB's latest innovation in the packaging industry is an environmentally effective pallet, light to handle but still rigid. The pallet system is called NWB InnoPal. The pallet is formed of corrugated base plates with plastic legs under the corners. The legs are made of recycled plastic to make the pallet more environmentally friendly.

Normal sizes are typically 400 x 600 or 600 x 800 mm, but other sizes can be made upon request. This cost-effective pallet system can be used not only for transport but also to display the products on a shop floor. The surface of corrugated board can be flexo printed according to brand design.

CUSTOM-DESIGNED PRODUCTION LINES

NWB's experienced team can help customers build a production line for packaging liquids. Our team members have several decades of experience in the beverage industry. We know how to help customers design in-house logistics for machinery in their production lines. Lines can be fully automatic or manual, or anything in between. We design lines using the best possible machinery on the market manufactured by our own subsidiary as well as other brands.

CONTACT

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RENEWABLE PAPERBOARD BOTTLE

ESBOTTLE presents a new type of packaging for any liquid – a paperboard bottle. Made only from renewable materials, all parts of the bottle are made of completely organic cardboard free of toxic chemicals. Paperboard bottles are made to hold almost any type of food. Any size and a number of shapes are possible. After use, the paperboard bottle can be recycled along with regular cardboard and paper.

ENVIRONMENT-FRIENDLY

If the consumer throws the bottle away, it decomposes, taking from six months up to five years, without any harm to the environment. A paperboard bottle is 30–50% cheaper to manufacture than a traditional plastic bottle. Our paperboard bottle is the most ecological and effective solution to the problem of plastic pollution.

FULLY AUTOMATIC PRODUCTION LINE

Esbottle's paperboard bottle production is fully automated. One operator controls everything. It all starts with the choice of drink, bottle size and design. Every type of bottle can have an individual design. Several large factories around the world are producing this patented type of cardboard under the Esbottle license.

Production starts with a paperboard roll from which blanks for bottles and bottoms are cut. Blanks are folded in a patented way. The bottom of the bottle is formed from cardboard circles. The machine folds the bottle from cardboard strips. After the cap is installed, the bottle is sterilized with hydrogen peroxide and pressure tested.

PRESSURE-RESISTANT FOR MOST LIQUIDS

The bottle can withstand pressure up to 6 bar. After the bottle is positioned upside down, the drink is poured into the bottle and the bottom is attached. A laser engraves the packaging date. The next step is branding. The design is applied by inkjet printer directly onto the bottle with photo-like quality. Boxes for packing the

bottles are made from recycled materials. The productivity of one line is from 2,000 to 3,000 bottles per hour. Bottles of different sizes can be produced on the same line. There is no need for a separate bottling line. This is a fully automated and environmentally friendly production process. The payback period of the line is 3 to 5 years.

SAFE TO DISPOSE

Our paperboard bottle is made from renewable materials, does not contain toxins and can be safely recycled. It does not harm the environment and is safe for humans. And it's cheaper than a plastic bottle. It's time for reasonable consumption and respect for nature. Using paperboard bottles is one of the best ways to protect our natural habitat for future generations.

READY TO ROLL

Our first machine will start up in June 2021 in Finland, packing carbonated water in 0.4-liter bottles. The next machine is under development for 2022.

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RENEWABLE FOOD PACKAGING

Jospak®

JOSPAK has created the Jospak® tray to combine the best functionalities of board and plastics. The tray is formed from renewable and recyclable board and helps reduce the amount of plastic used by up to 85%. It is material efficient and distinctive. Brand and product information can be printed directly onto the tray, thus also helping with the challenge of overpacking. Current trays used by the food industry are made mainly of fossil-based plastics. Because the collection of post-consumer plastic packaging waste and the recycling of diverse plastic grades are difficult, they produce a great challenge for the economy and environment.

The Jospak® tray offers a sustainable packaging solution for the food industry and food service when a gas-tight and recyclable packaging is required. Fields of application include various fresh and processed food products in modified atmosphere packaging, such as meat, poultry, fish, plant-based protein products, salads and ready meals.

UNIQUE TECHNOLOGY

Jospak's unique technology combines the board and plastics without adhesives and then converts them into pre-made nested trays. The plastic liner provides excellent gas- and liquid-barrier properties and enables closing with a top film. The octagonal Jospak® tray shape with a de-nesting feature makes it compatible with the existing automatic tray packaging process in the food industry without additional investments.

SUSTAINABLE SOLUTION AND OPERATIONS

Jospak meets all the EU legislation for primary food packaging. Furthermore, the

board materials are sourced from sustainably managed northern forests and the supply chain is FSC® CoC certified. The Jospak® tray is safe to use. Production operations are certified according to the BRC Global Standard for Packaging Materials, Issue 6. Disposal is easy, as the consumer can separate the plastic film and recycle both materials in separate waste management systems.

ABOUT JOSPAK

Established in 2014, Jospak manufactures patented, gas-tight board-based trays and develops the related converting technology in Forssa, Finland. Jospak's mission is to help the sustainable food industry reduce both packaging and food waste. Jospak provides food brand owners with an excellent way to differentiate and increase their brand visibility as well as giving consumers a convenient solution for recycling the packaging.

ACKNOWLEDGEMENTS

- WorldStar 2019 Sustainability Gold Award from the World Packaging Organization
- WorldStar 2019 Food Packaging Award from the World Packaging Organization
- Listing in "The most interesting companies in the circular economy" published by Sitra, 2019
- ScanStar 2018 Award from the Scandinavian Packaging Association

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PAPER STRAWS FOR THE CIRCULAR ECONOMY

dolea

DOLEA supports the global circular economy by producing drinking straws that are sustainable, recyclable and biodegradable.

USER FRIENDLY

Dolea straws are suitable for all drinks, including hot drinks and alcoholic beverages. Dolea straws will not leak melting glue into your drink. A single seam along the length of the straw gives you an even flow of your drink, making it more user friendly than any other paper straw.

ZERO GLUE

Dolea straws do not have any glue or additional chemicals in them. You'll have only the fresh taste of your drink. A single heat-sealed seam translates into a 25% reduction in material consumption.

NO STAIN ON NATURE

Dolea straws are certified recyclable as paper waste according to the PAP 21 standard and are repulpable, thereby enabling a circular economy.

LOCAL PRODUCTION, GLOBAL EFFECTS

Dolea straws are made in Finland. Dolea manufactures patented straw machines for straw production. The company will soon have converters producing these straws locally all over the globe, guaranteeing customer satisfaction in an environmentally conscious manner.

ABOUT DOLEA

Dolea Ltd. is a cleantech company from Finland. Dolea straws actually shift drinking straw production and consumption from a linear economy to a circular one. Dolea straws will soon be on everyone's lips all over the world – leaving no waste in the ocean or on land.

CONTACT

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MATERIALS THAT MIMIC NATURE

SULAPAC

SULAPAC provides sustainable, functional and beautiful biocomposites for injection molding and extrusion. The materials are suitable for various applications from luxury and food packaging to clothing hangers and cutlery. Our portfolio also includes some ready-made products, such as the Sulapac straw and jars for cosmetics and foodstuff provided by our industry-leading partners.

NATURAL RENEWABLE MATERIALS

Sulapac materials are bio-based, sustainably sourced and recyclable via industrial composting – designed to reduce plastic pollution. They also biograde in open environments and leave no permanent microplastics behind. Thanks to the eco-design and climate-conscious raw materials and manufacturing, the carbon footprint is small.

SUSTAINABILITY MADE EASY

Along with adding value through sustainability, Sulapac materials provide outstanding usability for the applications they are intended for. They are designed for mass production. Sulapac materials can be used with existing plastic converting machinery, enabling a practical and resource-efficient transition toward a cleaner future.

Furthermore, Sulapac materials never compromise on aesthetics. They have a beautiful, natural appearance, helping our customers stand out from the crowd while demonstrating their commitment to sustainability.

SAVING THE WORLD TOGETHER

We believe that the plastic waste problem can only be solved together. Hence, we cooperate closely with our customers and partners, such as Stora Enso and Chanel, but also with organizations, such as the Ellen MacArthur Foundation and the Technical Research Centre of Finland (VTT). We are also part of the FinnCERES Redefining Bioeconomy program.

ABOUT SULAPAC

Sulapac accelerates a plastic waste-free future with sustainable materials that are beautiful and functional, like nature. The Helsinki-based company was founded in 2016 by two biochemists – Suvi Haimi and Laura Tirkkonen-Rajasalo. Sulapac has been ranked one of the 100 hottest startups in Europe by WIRED UK.

CUSTOMER REFERENCES

- Stora Enso
- Fazer
- Quadpack
- Nissha
- Leader Foods

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ENVIRONMENTALLY FRIENDLY PACKING SOLUTIONS

versowood

VERSOWOOD manufactures packaging products from sustainable and renewable wood. Our main packing products are wooden pallets and cable drums. Wood naturally stores carbon by absorbing carbon dioxide from the atmosphere, where it remains secured until the end of the wood's lifecycle. One cubic meter of wood binds roughly around 715 kilos of carbon dioxide. Replacing non-renewable packing products, such as plastic and metal palettes or cable drums, with wood helps store significant amounts of carbon dioxide.

PALLETS FOR INDUSTRIAL NEEDS

Around 4 million pallets are manufactured in Versowood's factories every year. In addition to pallets manufactured to customer specifications, our product range includes standardized EUR and FIN pallets. Pallets are made from timber that complies with the requirements set forth in the ISPM 15 standard. Our pallet production, sales and service operations comply with the ISO 14001:2004 standard for environmental management systems. All our wooden pallets are manufactured on modern and automated production lines.

DURABLE CABLE DRUMS

We manufacture wooden drums up to 3,900 mm in diameter from high-quality timber produced at the company's sawmills and dried according to the ISPM 15 standard. In addition to timber, drums can also be made from plywood. Wooden cable drums are long lasting and can be repaired and maintained. As the drum reaches the end of its lifecycle, it can be recycled in an environmentally friendly manner.

ABOUT VERSOWOOD

Versowood is Finland's largest private company in the field of mechanical wood processing. The company's turnover is about EUR 400 million, and we have about 800 employees. Versowood has five

sawmill lines and purchases about 3.5 million cubic meters of logs every year. Wood sourcing is based on the Programme for the Endorsement of Forest Certification (PEFC) system. We export to almost 60 different countries around the world. Versowood is a reliable and long-term partner for its customers.

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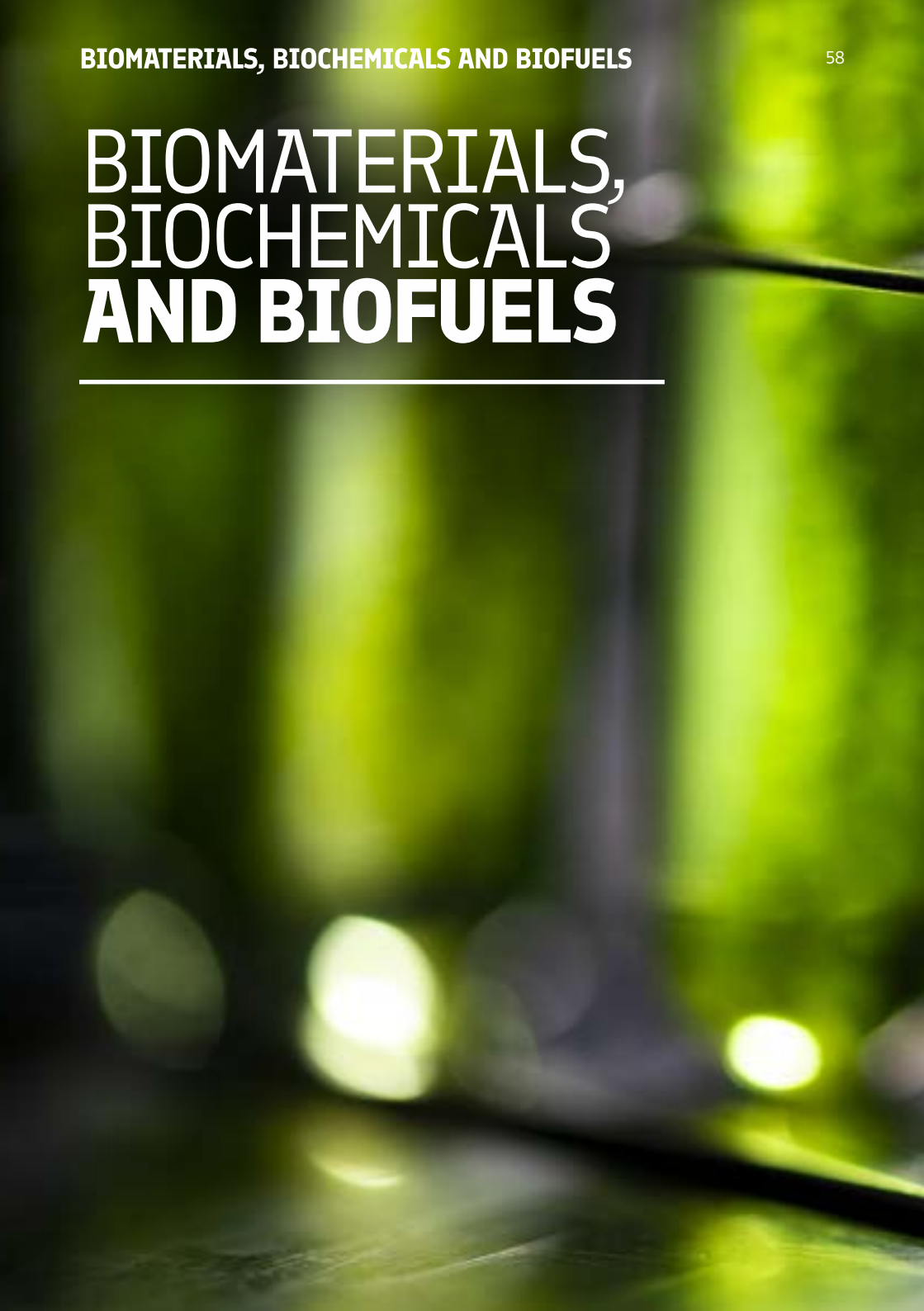
BIOMATERIALS, BIOCHEMICALS **AND BIOFUELS**



INNOVATIONS FROM BIOMATERIALS

STORA ENSO'S Biomaterials offers a wide variety of pulp grades to meet the demands of paper, board, tissue, textile and hygiene product producers. The company also maximizes the business potential of its process side streams, such as tall oil and turpentine from biomass.

The Biomaterials division has developed a strong business portfolio for lignin, regenerated cellulose in textiles and bio-based chemicals. Biomaterials innovations are one of Stora Enso's key strategic focus areas, with a particular focus on lignin and targeting strong growth in new applications and markets.

The company's strong innovation approach has led Stora Enso to explore the potential use of all fractions of biomass, such as lignin and sugars, for use in various applications. For example, the company is building a pilot facility at its Sunila Mill in Finland to produce bio-based carbon materials based on lignin. Wood-based carbon can be utilized as a crucial component in the batteries typically used in consumer electronics, the automotive industry and large-scale energy storage systems.

A PARTNERSHIP TO DEVELOP BIO-BASED CARBON FIBRE

Stora Enso and Cordenka, a leading producer of premium-quality industrial viscose fibres, are developing precursors for bio-based carbon fibre to replace oil-based raw materials. The co-development

is driven by the need for high-performance carbon fibre in transportation, construction and power generation. The partnership's initial target is to develop carbon fibre for industrial applications requiring low weight and high mechanical performance, such as pultruded laminates used in manufacturing rotor blades for wind energy.

Part of the bioeconomy, Stora Enso is a leading global provider of renewable solutions in packaging, biomaterials, wooden construction and paper. We employ some 23,000 people and have sales in more than 50 countries. Our shares are listed on the Helsinki (STEAV, STERV) and Stockholm (STE A, STE R) stock exchanges.

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WOOD-BASED BIOFUELS PAVE THE WAY FOR CLEANER TRAFFIC

UPM BIOFORE BEYOND FOSSILS

UPM'S wood-based UPM BioVerno diesel is a sustainable alternative to fossil fuels in transport, enabling users to effectively and easily reduce their emissions and carbon footprint.

Made from tall oil, a residue material from pulp making, UPM BioVerno is a fully renewable diesel. No extra trees are felled to produce it, and unlike first-generation biofuels, it does not compete with food production.

UPM BioVerno is an immediately available solution for mitigating climate change and reducing transport emissions. It reduces the use of fossil fuels in road transport while making it possible to achieve an astounding 80% reduction in CO_2 emissions compared to fossil diesel – without any compromise in performance.

The wood-based fuel innovation also reduces tailpipe emissions, such as fine particles and nitrogen oxide, and thereby helps improve air quality locally.

A CONVENIENT DROP-IN SOLUTION

UPM BioVerno's physical properties and quality are identical to fossil-fuel diesel, which makes it extremely convenient to use. It behaves in the same way as fossil-fuel diesel in all diesel engines and fits seamlessly into existing distribution systems. A true drop-in solution that does not require costly investments in new vehicles or infrastructure.

Unlike traditional biodiesel, UPM BioVerno can be used both as part of a mixture and

by itself. Lower emissions are achieved even when used in blends. In addition to powering diesel cars, buses, trucks or boats, UPM BioVerno can also be used in industrial machinery.

REFERENCES AND AWARDS

- Renewable diesel UPM BioVerno won the EU's Sustainable Energy Europe award in 2014.
- UPM Biofuels won the Bioenergy Industry Leadership award in the Platts Global Energy Award in 2017.

ABOUT UPM BIOFUELS

UPM Biofuels produces renewable and sustainable products for the transport and petrochemical industries. We offer our customers ways to replace fossil-fuel raw materials and reduce their carbon footprint. UPM's innovative, bio-based products are frontrunners in quality, usability and sustainability.

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THE SUSTAINABLE MATERIAL COMPANY

SPINNOVA®

SPINNOVA believes the material world as we know it has reached a turning point. The textile industry wonders if it can continue to exist. Brands and manufacturers all over the globe are struggling to find ways to leave the linear models of the past behind and ensure a more circular and sustainable tomorrow – a tomorrow with less waste, lower CO_2 emissions and no harmful chemicals or excessive water use.

It's easy to talk about change, but a whole different thing to make it happen. That's where we come in. Spinnova, a Finnish textile material innovation company, is speeding up the long-awaited fundamental shift in industry practices.

UNIQUE TECHNOLOGY

We are the only company in the world able to create textile fibre from cellulose with minimal water use, lower emissions and zero waste, and without any harmful chemicals. Our patented technology is based on a mechanical treatment of the cellulose fibre, instead of the dissolving and harmful chemical processes normally used for turning cellulose into textiles.

NATURAL SUSTAINABILITY

Spinnova is a 100% natural fibre made of wood. Over its entire lifecycle, this cotton-like fibre is produced with 99% less water and significantly lower CO_2 emissions compared to cotton.

Spinnova's unique sustainability aspects also include zero harmful chemicals, zero microplastics, 100% recyclability and fast biodegradability.

READY FOR FUTURE MARKETS

After five years of hard work, testing, piloting and cooperating with some of the leading fashion and clothing brands in the world, we are now ready for commercial scale-up.

Behind this market readiness are our technical maturity, fibre quality and partnership with Suzano, the world's largest pulp producer. We are now scaling up to manufacture Spinnova to meet the industry's urgent demand for a renewable solution. We will start with the production of wood cellulose-based fibre at scale and plan to expand by using our patented technology, turning waste streams into quality textiles.

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BIOCOMPOSITE FOR PLASTIC REINFORCEMENT

AQVACOMP OY develops and manufactures a natural fibre composite made of a renewable pulp fibre to replace plastics and the reinforcements used for plastic, such as fibreglass and mineral fillings. The key purpose of mixing pulp fibre into plastics is to improve the mechanical, physical and chemical properties of plastics and to reduce the amount of fossil-based plastic.

NUMEROUS BENEFITS

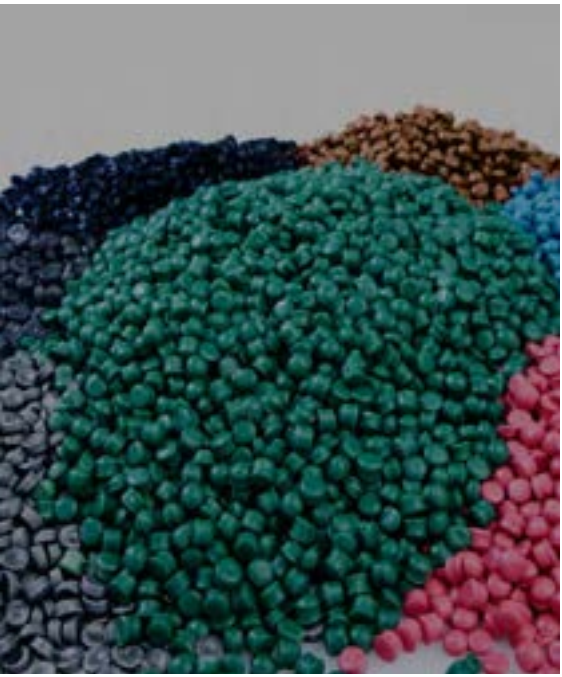
Aqvacomp's biocomposite is specially designed for injection molding applications. The solution features moldability of granulates for a wide range of end products with precise details. It is isotropic – with excellent strength and weight performance. It demonstrates excellent thermal resistance and is fully odorless, having no volatile organic compound (VOC) emissions. The solution also provides unique haptic (tactile), acoustic and aesthetic performance, unlimited dyeing possibilities – allowing even white shades – and great paintability. In addition, Aqvacomp's solution features improved mechanical properties and processability compared to dry mixed cellulose composites and is compatible with injection molding simulation software.

THREE-DIMENSIONAL REINFORCEMENT

Unlike conventional composites, Aqvacomp's biocomposite reinforces plastic three dimensionally. The biocomposite is up to 100% based on renewable resources and is also 100% recyclable. There's no need to add additional virgin material in the recycling process for at least six times. Compared to oil-based material, our biocomposite reduces the carbon footprint by up to 40%. It also has up to 30% lower energy requirements in the production process. Aqvacomp's biocomposite is patented.

SUCCESS FACTORS

Aqvacomp's success is backed by numerous factors. First, there is a large global market for technical polyolefin compounds in many target groups and customer segments as a sustainable alternative to



fossil-based materials. Second, our state-of-the-art wet web-forming technology is also widely used in other industries. The solution is a masterbatch, which means that a polymer matrix binds with biofibre to create a rigid 3D bond. What's more, Aqvacomp's technology is easily scalable and can either be used close to a pulp mill or independently of it. The production line capacity can range from 10,000 tons up to 100,000 tons annually. Furthermore, cellulose is the most common natural fibre in nature and is renewable in less than 20–30 years, ensuring continuous high availability of the solution.

No similar technology exists in the market. Because of the rising environmental awareness of consumers and ever-tightening legislative decisions, the business potential of Aqvacomp's biocomposite is expected to grow.

ABOUT AQVACOMP

Founded in 2014, Aqvacomp operates the world's first fully integrated pulp fibre composite plant at Metsä Fibre pulp mill in Rauma in Western Finland. Aqvacomp's main product is a pre-dispersed pulp fibre masterbatch with matrix polymers ranging from polyolefins, styrene-based polymers as well as recycled , bio- and biodegradable polymers.

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IDEAS FOR THE BIOECONOMY

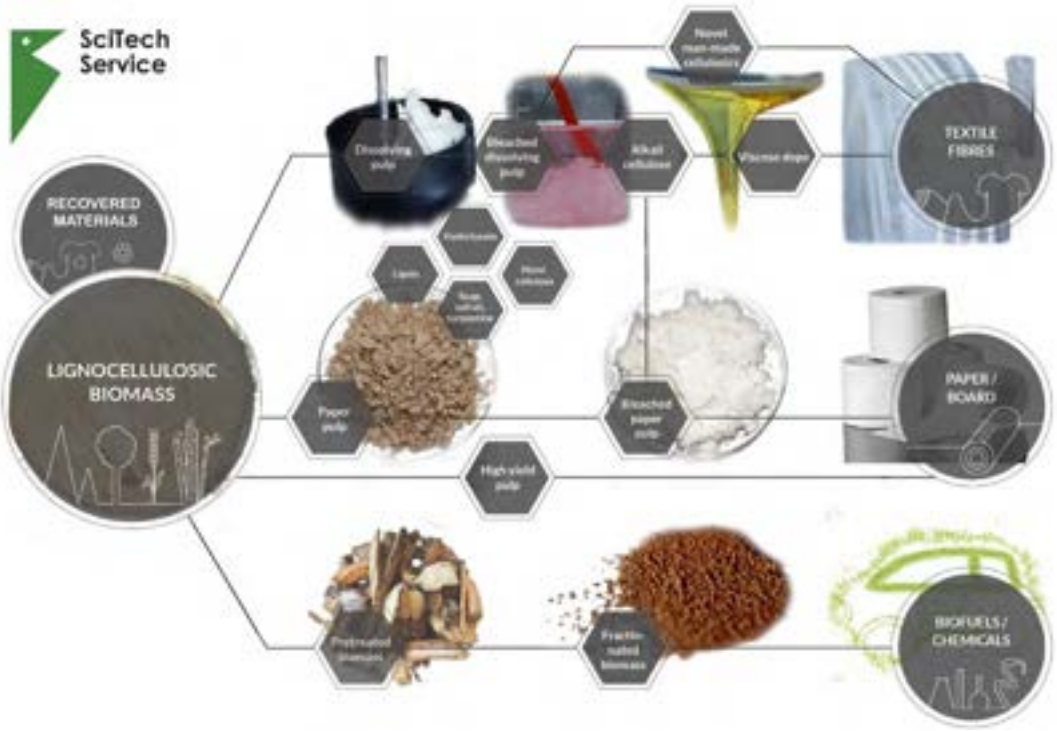
SciTech Service

SCITECH SERVICE believes truly bio-based, renewable and sustainable products are seeing a significant increase in consumer demand. The paradigm shift has been rapid, and industry is trying to react accordingly. Now, companies face opportunities to create products and services suitable for this new era. SciTech Service's broad experience in outsourced technology development means that we can help clients understand the challenges in many fields of biomass processing. These include the manufacture of paper, board, dissolving pulp, fluff and high-yield grade pulps, viscose production, other regenerated cellulose products and biochemicals.

We are a fast, reliable and flexible operator with ever-growing expertise in several biomass raw materials and concepts. Our mindset is focused on adding value for our clients. No idea is too innovative to at least try to conceptualize together.

TRUSTED COOPERATOR WITH BROAD NETWORK

Since 1983, we have served the biomass conversion industries as well as related plant engineering and equipment manufacturing companies. Our services include concept-level process design and evaluation, planning and execution of laboratory



and scale-up studies, second-opinion services for technical concepts as well as mill conversion and improvement services.

SciTech Service participates in the ExpandFibre ecosystem, the PoDoCo project and the Lignin Club. We also have our own expanding network of industry professionals and experts.

ABOUT SCITECH

SciTech wants to help mankind find a travelable path to a circular bioeconomy. We operate in Helsinki, and our laboratories are in Rauma and Otaniemi in Espoo. We provide top-level expert and laboratory services to support the aspirations of our clients, developing our own ideas to provide the missing steps along the path to a bioeconomy.

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ENHANCING THE VALUE OF LIGNOCELLULOSIC BIOMASS

METGEN is one of the leading innovators in creating and developing bio-based technologies. Our mission is to enable industries to enhance the value of lignocellulosic biomass through enzymatic solutions.

MetGen addresses the demand for creating more sustainable production solutions, helping to meet the ever-growing desire to increase sustainability, reduce environmental pollution, minimize the carbon footprint and conserve biodiversity.

The switch to bio-based feedstocks allows the chemical industry to cut dependency on finite fossil feedstocks and increases the use of more resource-efficient bio-based technologies. MetGen is at the core of this development.

MetGen produces enzymes on an industrial scale, providing commercial enzymatic solutions to modern biorefineries and the pulp & paper and biogas industries.

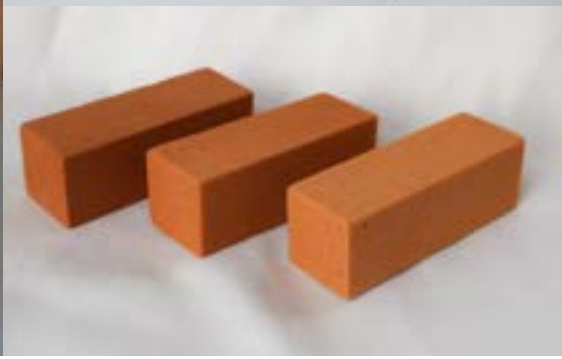
Our philosophy is to design enzymes for maximum impact in real-life process conditions.

METZYME® FOCUS TECHNOLOGIES

MetZyme® SUNO™ catalyzes saccharification of polymeric sugars and eliminates multiple inhibitors, enabling more thorough hydrolysis, higher yields and more pure sugar products.

MetZyme® PURECO™ enables biochemical reactions such as glucose isomerization, glucose bioconversion to platform sugars and further conversions to platform chemicals. Its ability to tolerate a wide range of inhibitors and more demanding process conditions makes it unique.

MetZyme® BRILA™ provides improved value-added paper quality characteristics to recycled fibre-based paper and board



products along with measurable process runnability improvements.

MetZyme® POVON™ has extreme thermal stability and inhibitor resistance in addition to pure and specific enzyme activity, strengthening cellulose fibre without destroying it. POVON™ is ideal for dissolving pulp, microfibrillated cellulose (MFC), cellulose nanocrystals (CNC) and other specialty pulp applications.

METZYME® METNIN™

MetGen's METNIN™ is the state-of-the-art enzymatic lignin refining technology, enabling controlled fractionation, high yield, low capital expenditure and operational costs and high output. The technology provides the missing link in the value chain between crude lignin and high-value lignin end-user applications. Compared to crude lignin, METNIN™ enables a high-level lignin valorization for a much wider range of drop-in solutions in coatings, resins, plasticizers, polyurethanes and binders.

Our diverse and flexible business models allow very comprehensive and fruitful ways to cooperate. Join us in leading the way toward a more sustainable future.

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REVOLUTIONARY ANTIMICROBIAL PROTECTION

NordShield®

NORDSHIELD® offers a uniquely sustainable and highly efficient alternative to the issues of harmful antimicrobials currently in use. Current standard antimicrobial solutions are based on heavy metals such as silver, silver zeolites, copper or zinc, which leach into our environment and our bodies, and are an immediate threat to our health.

NordShield® is a natural-based technology, utilizing side streams from the forest industry. It is safe for users and the environment. Fields of application for the NordShield® technology include fibres and textiles, as well as medical devices, personal care solutions and long-lasting disinfectants.

UNIQUE BARRIER TECHNOLOGY

This unique technology forms an antimicrobial barrier on the treated surface. The barrier creates a durable antimicrobial layer, inactivating potential viruses, bacteria or fungi. This physically stops them from spreading and protects the surface from further contamination. It also inhibits so-called superbugs from developing, as a potential mutation can be stopped.

SAFE, SUSTAINABLE SOLUTION

Our partners are committed to offering non-harmful, safe and sustainable solutions to their customers. Our brand can strategically help our partners grow and position themselves as a valued player within the current consumer megatrends of naturality and sustainability.

NordShield® as a commercial technology was born after more than 10 years of researching, developing, testing, verifying, certifying and patenting. The result is a revolutionary technology with a unique

combination worldwide of naturality, power and efficacy. Our technology enables the strongest protection with the highest naturality – a creation as unique as our nature.

ABOUT NORDSHIELD

Founded in 2016 and headquartered in Espoo, Finland, NordShield® is the world's leading supplier of natural-based antimicrobial solutions. We are disrupting the field of antimicrobial technology with our durable, natural-based and safe alternative for antimicrobial protection that can be utilized across applications and industries.

ACKNOWLEDGEMENTS

- Part of Fashion for Good Accelerator Programme
- Winner of Sustainable Healthcare Innovation Award 2019 (Award by Nordic Center for Sustainable Healthcare)

CONTACT

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UTILIZING PULP AND PAPER MILL SLUDGES IN AGRICULTURE

SOILFOOD'S core competence is identifying usable side streams and utilizing them for agricultural production. We provide full-service side stream utilization for industry and offer agronomic know-how and a wide range of recycled fertilizers and soil improvers for farmers. We understand the needs of both client groups.

Using pulp and paper industry sludges as soil improvers in agriculture is an ecological option for handling side streams. As these by-products contain nutrients and organic carbon, they offer valuable resources for agriculture.

Our solution adds value to all stages of the supply chain and has no negative effects. Soilfood's solutions can be deployed without an initial investment.

EFFICIENT SOLUTION

Using side streams as raw materials instead of fuel, our circular economy solution is cost effective and material efficient. CO_2 emissions are reduced as carbon is stored in the soil and chemical fertilizers are replaced by recycled nutrients.

Soil-improvement fibres refined from pulp and paper industries side streams add a significant amount of organic matter and nutrients to the soil. The nutrients and organic carbon are utilized in arable land to build soil health, reduce erosion and improve yield levels.

A significant proportion of the added organic matter decomposes very slowly, allowing the carbon to bind with the soil for

decades or even centuries. This treatment is proven to effectively reduce nutrient leaching from farmlands.

ABOUT SOILFOOD

Established in 2015, Soilfood today processes side streams from 40+ industrial clients in Scandinavia. Leading pulp, paper and bioenergy companies recycle their side streams through our services. Our operations are based on active research and development. We are constantly innovating new solutions for by-products and developing new fertilizers and soil improvers.

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LONG-TERM CARBON BINDING WITH WOOD CONSTRUCTION

versowood

VERSOWOOD manufactures sawn timber and other further processed products, such as glulam, planed sawn timber, finger-jointed timber, painted and impregnated products, telephone and electric poles and wooden bridges. Wood construction can bind carbon to structures for decades and act as a natural carbon store.

QUALITY COMES FROM MODERN SAWING

Versowood's modern sawmills produce high-grade sawn timber for construction and industrial purposes, such as those needed by the door, window and furniture industries. We manufacture high-quality and dimensionally accurate sawn timber. We manufacture CE-marked finger-jointed timber. With finger-jointed extensions, we can produce longer sawn timber products that are very straight and dimensionally accurate.

ECOLOGICAL SUSTAINABILITY WITH GLULAM PRODUCTS

Glulam is a strong and ecological construction material and is easy to install. It can be used in small and large buildings, such as sports halls, schools, kindergartens or blocks of flats. Glulam is especially suitable for construction sites where long spans are needed in load-bearing structures.

Versowood's King Panel is made of split spruce glulam. The massive King Panel is modern and impressive exterior cladding material. King Panel has exceptional dimensional stability.

We also produce telephone and electricity poles from salt and creosote-impregnated wood as well as wooden bridges. Wooden bridges are a cost-effective and durable alternative to concrete bridges.

ABOUT VERSOWOOD

Versowood is Finland's largest private company in the field of mechanical wood processing. The company's turnover is about EUR 400 million, and we have about 800 employees. Versowood has five sawmill lines and purchases about 3.5 million cubic meters of logs every year. Wood sourcing is based on the Programme for the Endorsement of Forest Certification (PEFC) system. We export to almost 60 different countries around the world. Versowood is a reliable and long-term partner for its customers.

ACKNOWLEDGEMENTS

- Winner of the 2018 Wood Award, Tuupala Primary School and Daycare Center
- Mansikkamäki School, Kouvola
- Sibelius Hall, Lahti
- Niemenharju Tourist Center, Pihtipudas

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SUSTAINABLE MATERIAL SOLUTIONS FOR THE FUTURE

Brightplus

BRIGHTPLUS creates reusable, recyclable and biodegradable side-stream material solutions. We help leading global manufacturers and major Fortune 500 brands in industries such as packaging, agriculture, household and electronics achieve their sustainability goals. Our BrightBio® technology is the foundational chemical building block from which we can quickly and efficiently innovate new coatings, barrier films, materials and other products.

GREEN AND EASY TO APPLY

Brightplus upcycles side-stream-based sources to reduce the circularity gap and meet the EU Green Deal targets. We create alternatives from renewable carbon sources to replace fossil fuel-based counterparts. Our green chemistry methodology ensures ultimate ecological solutions for numerous industries. Our easy-to-apply premium material solutions fit directly into existing industrial workflows.

UPCYCLING TO YOUR ADVANTAGE

Using our deep-tech visionary chemistry, the pioneering BrightBio® hybrid technology upcycles biosourced side-stream flows to create bio-based industrial materials. One great example is our protective and decorative water-based coatings for luxury perfume flacons. Generally, our products range from liquid solutions to thermo-formable polymeric materials that replace plastics. We work closely with customers from an early stage to ensure that solutions are practical from the outset and seamlessly comply with their existing processing methods and product requirements.

FOCUSING ON SUSTAINABILITY

We provide sustainable innovations as a service for BrightBio® technology-based coatings, side-stream mono-material solutions and tailored components.

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WOOD PRODUCTS AND **CONSTRUCTION**

SUSTAINABLE BUILDINGS WITH ENGINEERED WOOD PRODUCTS

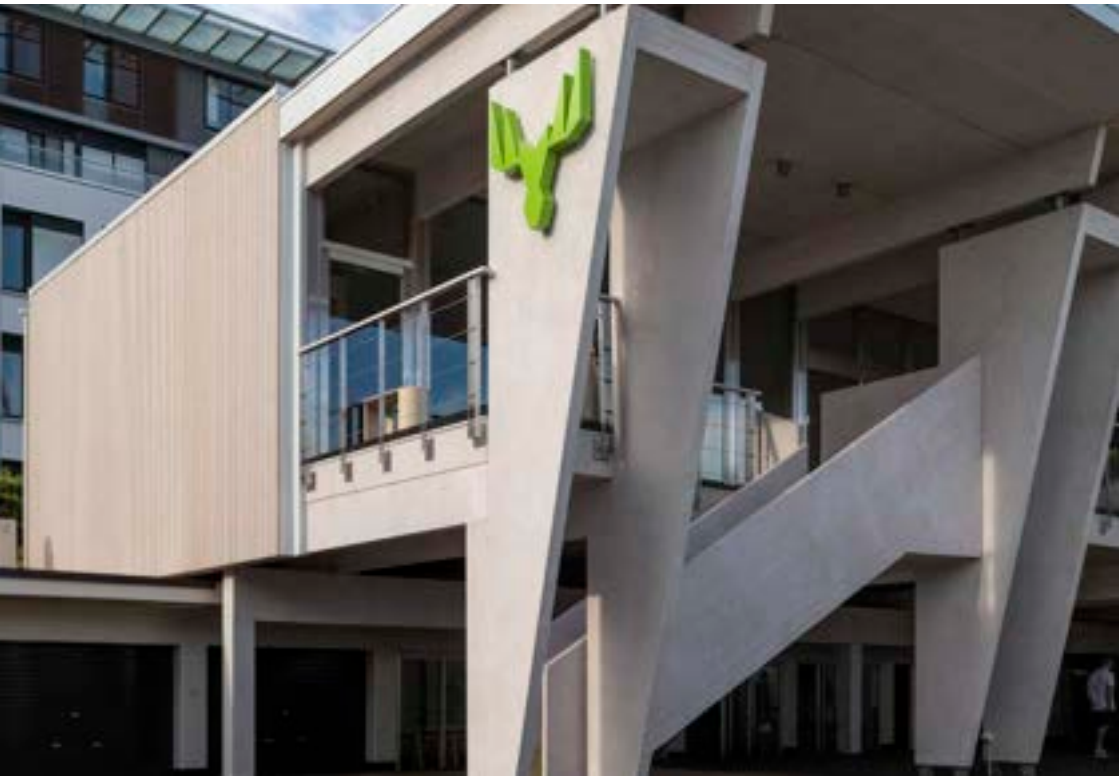
METSÄ GROUP is one of the leading European producers of engineered wood products. We provide premium-quality wood products; birch and spruce plywood and Kerto® LVL products. Building with wood is a sustainable solution to the challenges of population growth. Our wood products are made for the needs of the construction and transport industries.

KERTO® LVL MAKES CONSTRUCTION FAST, LIGHT AND GREEN

Kerto® LVL is a laminated veneer lumber product used in all types of construction projects, from new buildings to renovation and repair. Kerto® LVL is an incredibly strong, dimensionally stable and lightweight construction material. It delivers high strength from homogeneous bonded structure beams, planks or panels manufactured to customer requirements. Kerto® LVL is made from the biggest logs grown in the northern forests. These logs are rotary peeled, and the veneers are converted into construction products with a high added value, ideal dimensions and exceptional strength that are far above those of conventional sawn timber.

LESS WEIGHT, LESS ENERGY

The lightness and strength of Kerto® LVL engineered wood products provide a very attractive and resource-efficient option for construction in urban areas. Using prefabricated Kerto® LVL elements and modules has multiple benefits. Because the building parts are lighter, less energy is needed for transportation and erection, saving time and money during the construction project. The wood used in the



structural components compares well in strength to concrete and steel alternatives. Its excellent strength-to-weight ratio means less wood is needed to achieve the same strength as that of steel and concrete beams.

ABOUT KERTO® LVL AND METSÄ GROUP

Metsä Group has been producing Kerto® LVL since the 1970s. LVL is a well-known product around the world. The latest Kerto line started up in 2019 in Punkaharju, Finland. It provides Metsä with the world's most flexible production equipment for manufacturing LVL.

INDUSTRIALLY EFFICIENT WOOD CONSTRUCTION

The Metsä Pavilion is Business Finland's project in Tokyo with Metsä Group as the main partner. The elegant pavilion highlights innovative architecture based on industrially manufactured wooden elements from Kerto LVL. The Metsä Pavilion is a showcase of how to construct a stylish building quickly and efficiently by using standard elements.

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A LEADER IN INNOVATIVE WOOD-BASED SOLUTIONS

STORA ENSO Wood Products is the largest sawn wood producer in Europe and a leading provider of sustainable wood-based solutions for the construction industry. Our growing Building Solutions business offers versatile materials and building concepts to support low-carbon construction. Related digital tools simplify the designing of building projects. The portfolio also covers applications for windows and doors and for packaging industries, while pellets provide a sustainable heating solution.

HIGHER, STRONGER AND LIGHTER BUILDINGS

Megatrends like urbanization and eco-awareness will change the construction industry which emits 11% of global CO_2 today. Mass timber construction can reduce the emitted carbon by up to 75%. This creates significant opportunities for the growth of wooden construction globally. Interest in building with wood is growing among construction companies and investors, and there are several governmental policies supporting the growth. Stora Enso wants to create an ecosystem in urban wooden construction with other value-chain parties.

A WIDE RANGE OF WOOD PRODUCTS AND SOLUTIONS

Stora Enso's wide product portfolio, including cross-laminated timber (CLT) and laminated veneer lumber (LVL), enables bundling the best-fitting products for each customer and project. Products are covered with third-party verified Enviromental Product Declarations (EPDs), which help in understanding a product's life-cycle envi-

ronmental impacts. The importance of EPDs is increasing with growing sustainability awareness. To develop the offering and provide new solutions, services and digital tools to boost and support wooden construction, innovation is high on the agenda. Stora Enso has delivered wooden materials globally to numerous modern construction projects. In Finland, the latest projects include the mobile game development company Supercell's new head office as well as Stora Enso's new head office in Helsinki (in the picture by Varma) that will be completed with Stora Enso's massive wood products. If all new construction in Finland were built from wood, the number of trees used would grow back in only five summer days.

ABOUT STORA ENSO

Part of the bioeconomy, Stora Enso is a leading global provider of renewable solutions. We believe that everything that is made with fossil-based materials today can be made from a tree tomorrow.

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FUNCTIONAL PLYWOOD FOR WOOD CONSTRUCTION

UPM BIOFORE BEYOND FOSSILS

UPM'S lightweight yet durable WISA®-Spruce products are suitable for all kinds of structural construction applications. Due to their excellent strength properties, they are a natural choice for load-bearing structures, such as roofs, walls and floors. In addition to traditional spruce plywood, the WISA®-Spruce product family includes fire-retardant plywood, biocide-treated plywood and water-repellent plywood. The different products are intended to make work easier and more efficient for the end user.

SURFACE TREATMENT INCREASES VERSATILITY

WISA®-Spruce^{FR} plywood fulfills the highest fire classification possible for wood-based material without compromising the plywood's excellent technical properties. This structural fire-retardant product can be used to replace complicated multi-layered structures, reducing material costs, requiring less storage space and making installation simpler and faster.

Water-repellent WISA®-Spruce^{WR} plywood enables efficient and effortless construction, even in changing weather and humidity conditions. The wood-based treatment slows down the absorption of moisture into the panel while allowing it to evaporate. WISA®-Spruce^{WR} can withstand momentary exposure to rain, delaying the need to protect it from getting wet.

WISA®-Spruce^{BT} is treated with a wood protective agent to give the panel good protection against wood coloring and decaying fungi during the construction work.

RESPONSIBLE AND SAFE

Third-party verified and internationally comparable Environmental Product Declarations (EPDs) are available for all WISA® plywood. These EPDs help constructors, designers and verifiers understand the product's environmental impact throughout its lifecycle, from the sourcing of raw materials to its disposal.

UPM Plywood offers high-quality WISA® plywood and veneer products for construction, vehicle flooring, LNG shipbuilding, parquet manufacturing and other industrial applications. In 2020 UPM Plywood sales were EUR 405 million, and the company had 2,300 employees. UPM has five plywood mills and one veneer mill in Finland as well as plywood mills in Russia and Estonia. www.wisaplywood.com

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GREATER CLIMATE BENEFITS WITH LONG SERVICE LIFE

VELJET KUUSISTO OY and the Kuusisto Group offer pressure-treated redwood products for building projects that require durable materials. These products are a sustainable and responsible choice. Impregnation prolongs the service time and durability of wood significantly, which also means there is less need to log forests.

Of all building materials, timber is the truly sustainable option. The amount of carbon dioxide stored in wood is many times greater than the emissions caused by processing logs into wooden building materials, making wood an extremely green material for construction. By replacing other building materials, such as concrete and steel, the CO_2 reduction effect can be even greater than the carbon storage effect of wood alone. Therefore, wooden construction materials have a significant direct and indirect impact on reducing emissions.

DESIGNED FOR OUTDOOR CONSTRUCTION

Impregnated timber has been designed especially for outdoor construction. It endures a range of different weather conditions. Impregnated wood is protected from decay, mold and termites, making it an excellent choice to ensure a structure is safe and will last. In the demanding weather conditions of Finland, 90% of patio builders and landscape gardeners choose impregnated wood.

ABOUT KUUSISTO GROUP

Founded in 1898, the Kuusisto Group manufactures wood-based products and is the leading supplier of impregnated redwood products in Finland. The group has been owned by the same family throughout its more than 120-year history. Our product portfolio includes a wide range of

different impregnated redwood products, such as boards, planks and round poles, elegant Siberian larch terrace planks as well as moldings and panels used in home furnishing.

ACKNOWLEDGEMENTS

- PEFC certified, label number PEFC/02-31-225
- NTR-certified products made according to the EN 335/351 standards
- The Key Flag Symbol granted to products
- CPR certificate, number 2412-CPR-337-01
- Member of the European Institute for Wood Preservation

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CLEAN ENERGY FROM THE FOREST

versowood

VERSOWOOD'S bioenergy operations produce environmentally friendly renewable energy from the by-products of production. Our annual wood pellet production is about 70,000 tons, which is equivalent to nearly 340 GWh of energy. Burning wood pellets does not contribute to carbon dioxide emissions, because they release only the same amount of CO_2 as the wood biomass would release if it decomposed in nature. Also the delivery chain between producer and end user is more efficient than it would be without the pelletizing process, because of the high bulk density. This means a lower carbon footprint for heating.

ENVIRONMENTALLY FRIENDLY HEATING

Wood pellets have a high calorific value. They are a good alternative to oil and gas heating and other traditional heating methods. Because they are safe and easy to use, wood pellets are an excellent solution for heating industrial buildings, farms, terraced houses and detached homes.

Our Hotti wood pellets are made of pure wood. They contain no bark, stones or other impurities. We maintain rigorous quality control to ensure the purity and quality of our pellets. Among the factors monitored by our quality control process are for example mechanical durability, bulk density, length and moisture content. Our quality control procedures are based on the EN ISO 17225-2 solid biofuels standard.

ABOUT VERSOWOOD

Versowood is Finland's largest private company in the field of mechanical wood processing. The company's turnover is about EUR 400 million, and we have about 800 employees. Versowood has five sawmill lines and purchases about 3.5 million cubic meters of logs every year. Wood sourcing is based on the Programme for the Endorsement of Forest Certification (PEFC) system. We export to almost 60 different countries around the world. Versowood is a reliable and long-term partner for its customers.

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wood
CO2
versowood

CARBON-NEUTRAL INSULATION SOLUTIONS

ECOUP is proud to introduce the Ekovilla slab – a carbon-negative, breathable wood fibre insulation that is easy to handle. The dense fibre structure keeps air inside, ensuring proper thermal insulation.

The unique slab has been created to respond to the needs of builders and contractors. The wood fibre installation made of recycled newsprint paper combines numerous excellent qualities. The safe, breathable product has over three decades of experience. It features good thermal insulation capacity. Its carbon-binding properties reduce the carbon footprint throughout its lifecycle. The Ekovilla slab is resilient and firm, making it easy to install. It can be used in both new construction and renovation projects.

As breathable houses gain more popularity, more prefabricated house elements come already insulated with Ekovilla slab.

BLOWN WOOL INSULATION

Ekovilla's blown wool product is a carbon-neutral insulation suitable for attic floors, ground floors and walls. It is Finland's market-leading insulation for single-family dwellings, but is also widely used in professional construction. Recycled newsprint is manually picked to ensure the cleanliness of the main material used to make this product. It has been used to insulate the homes of our customers for over 40 years. Ekovilla blown wool suits wood construction well and is ideal for use in the same projects as the Ekovilla slab.

AN ENERGY-SAVING PRODUCT FAMILY

The Ekovilla product family includes the following air barrier products – Ekovilla X5 air barrier sheet, Ekovilla X Reno, Ekovilla X feed-through seal and Ekovilla X sealing tape. With Ekovilla's product family, you can build energy-saving structures that are comfortable all year round.

Carbon neutrality, material reuse and energy efficiency form the basis of the solutions we offer.

We turn waste, by-products and other unwanted material into low-carbon products of higher-than-original value. A significantly larger amount of CO_2 is absorbed than is produced in the production of Ekovilla's wood fibre insulation products.

One of our product concepts is a carbon-neutral and plastic-free, energy- and material-saving insulation solution – Everwool. It is blown wool made of clean, dry mineral wool waste that we collect from our clients in the building industry.

ABOUT ECOUP

EcoUp provides ecological construction industry products and services to our clients and partners interested in upcycling thinking. Our team consists of 100 professionals, and turnover in 2020 was about EUR 25 million.

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CLEAR YOUR SOUNDSCAPE SUSTAINABLY

Lumir

LUMIR provides safe and seamless acoustic walls and ceilings that can be installed easily. These bio-based acoustic solutions give you limitless freedom to integrate acoustic materials into any architectural vision. We use over 80% wood-based materials in our products, which makes them sustainable and safe for users.

Acoustics have an impact on the usability and comfort of spaces – how we work, concentrate and understand. If a surface has poor sound absorption, it reflects the sound back into the space. Lumir acoustics are created using different acoustic base materials and a Lumir acoustic coating that absorbs the high frequencies. Unlike a wool panel surface, a Lumir acoustic solution is hard and durable.

ACOUSTIC SOLUTIONS

Lumir acoustic solutions are currently based on a sprayable acoustically transparent biofibre-based coating. The acoustic performance of the coating structures can be improved by using porous or acoustic materials, such as lightweight concrete, mineral wool or perforated gypsum as the base material.

Lumir acoustic coatings can be sprayed on any kind of base material, and the surface texture of the coating can be modified from very rough to smooth. The material allows an even, seamless and through-color surface with the proper color. The end result is a healthy, durable and bio-based solution.

Lumir acoustic solutions provide an effective reduction of reverberation for homes, public spaces, school offices and shops. They are also suitable for new construction and renovations.

PROVEN QUALITY IN PRACTICE

Lumir's products are developed by highly educated scientists from the fields of materials science and acoustics. Lumir aims to produce the highest quality acoustic solutions in the world that are also visually appealing. Lumir acoustic solutions are already used in more than 200 buildings in Finland.

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MODERN FINNISH DESIGN **WITH PURE MATERIALS**

REVOLUTION IN THE BATHROOM

woodio®

WOODIO is a Finnish eco-design and material technology company. We manufacture bathroom appliances from the world's first 100% waterproof solid wood composite. Our washbasin and other products have a minimal carbon footprint compared to their ceramic counterparts.

EXCEPTIONAL ADVANTAGES

Woodio's waterproof solid wood composite is made from real wood chips. Our washbasin's global warming potential (GWP) is 80% less than that of a similar-sized ceramic basin.

Our solid wood composite products are lighter in weight than traditional bathroom products, helping to reduce logistics emissions as well. They are also far more impact resistant, making them practically unbreakable under normal use.

Woodio washbasins are maintenance free- and easy to keep clean. When necessary, they can be cleaned with just a dampened soft cloth and mild non-abrasive dish detergent or soap.

SUSTAINABLE CHOICES

As a brand and a company, we stand for sustainable choices throughout the whole production process – from the material itself to manufacturing, long-term use and disposal.

Our Woodio material innovation was inspired by the idea of making more sustainable wooden bathroom tiles, as the ceramic industry is among the most polluting industries globally. Although this seemed extremely challenging and nearly impossible, we are glad we did – for a new material was born.

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MODERN FINNISH DESIGN WITH PURE MATERIALS

ISKU
Since 1928

ISKU'S journey has been shaped by its harsh northern surroundings since 1928, turning us into creative and practical team players. We have the courage to do things differently. We take responsibility for each other and the environment. We believe in design, individuality, craftsmanship and quality. We build environments that offer safe and comfortable places for us to grow up, study, work and thrive.

ENVIRONMENTALLY FRIENDLY CHOICES

To us, sustainable development comes naturally, and responsibility means action. This is embedded in our company DNA. ISKU fosters circular economy thinking and is a forerunner in eco-friendly production. ISKU is the only industrial company in the Finnish furniture sector that uses a PEFC chain of custody system to track the origin of the timber used. Above all, we prefer pure and environmentally sustainable materials sourced locally.

COMBINING NEW TECHNOLOGY AND CRAFTSMANSHIP

ISKU quality means carefully considered product design brought to life by combining professional craftsmanship, meticulously tested materials and advanced production technology.

ISKU's Grada line, for instance, combines a thermoformed wood board with robot technology to speed up furniture production on the machine line by 60%. This unique Grada technology has opened up a whole new world of design and innovative forms. ISKU's versatile Tutto chair collection is a great example of award-winning innovative design inspired by these novel manufacturing opportunities. Tutto provides its

users with stylish seating while maintaining the essential elements of comfort and usability.

Modern technology also requires the human touch to perform at its best. Craftsmanship and understanding of materials are an integral part of proven quality.

ABOUT ISKU

ISKU's story has its roots in Finnish wood and traditional carpentry skills. Since 1928, ISKU has designed durable, high-quality furniture for everyday living. The family business has opted for local production and responsible operations to ensure that it will offer its services for generations to come.

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FUTURE **PRODUCTS**

UPM Biofore Concept Car

NEW BIO-BASED TEXTILE FIBRE

METSÄ GROUP strongly believes that global demand for textiles will continue to grow. Environmental awareness is pushing markets to find more sustainable alternatives to the main raw material, polyester. Metsä Group is working for this on the front line, pushing forward new wood-based textile fibres.

The initial idea behind Metsä Group's concept was conceived a decade ago in the Future Biorefinery (FuBio) research program. After recognizing the potential of the new idea, Metsä Group developed the technology. Eventually, this endeavor has led Metsä Group into a partnership with Japanese ITOCHU Corporation and a joint demo-scale production facility.

NEW CHEMISTRY, ESTABLISHED TECHNOLOGY

The production technology applied – direct pulp dissolution and air-gap spinning – has been known since the 1980s. A new solvent and the raw material used are the source of Metsä Group's novel technology. The solvent is a specific ionic liquid – a molten salt – a Finnish discovery originating at the University of Helsinki. The solvent enables the use of materials like ordinary paper-grade pulp, as in the Metsä Group case. In contrast, the production of wood-based textile fibres typically uses so-called dissolving pulp, a chemically purified cellulose, as the raw material.

BENEFITS OF THE NEW APPROACH

Metsä Group's raw material choice – paper-grade pulp – is a bulk raw material compared to dissolving pulp. By using it, the material efficiency of the process is much better, for all carbohydrate components of wood are incorporated in the textile fibres. The ionic liquid used as the pulp solvent is a safe, non-toxic and efficient green chemical that makes a single-step dissolution process possible.

FUTURE PROSPECTS

The current demonstration phase is expected to last about two years. This phase keeps the demo plant team busy with further development of the technology, optimization of process parameters, testing of the produced fibre potential on the market and evaluation of the concept's profitability.

The FuBio program and ongoing demo phase are co-funded by Business Finland.

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NEW ECO-FRIENDLY AND CIRCULAR SOLUTIONS

STORA ENSO'S materials and innovations are based on the forest. Everything made with fossil-based materials today can be made from a tree tomorrow.

This ambition provides good opportunities for growth, but we cannot do it alone. The products and solutions of the future require collaboration with partners outside of the company and transformation across the value chain. Stora Enso's strong ecosystem of customers, suppliers, research institutions and startups enable future growth and is key to bringing new solutions to the market.

INCREASED FOCUS ON INNOVATION

Stora Enso's primary focus for innovation are in the areas where we have identified key business opportunities. In close collaboration with customers and partners, Stora Enso will target new sustainable packaging materials, sustainable barriers and the biochemical platform in lignin.

Through innovative work, Stora Enso aims to build and develop viable businesses from new opportunities. The company's world-class experts in fibres and chemistry are on a daily mission to transform biomass into renewable solutions.

Stora Enso is well linked to global research and thus adds value to our customers' businesses. The company's future product innovation sites are located in Finland and Sweden.

BIO-BASED CARBON MATERIALS FOR ENERGY STORAGE

For companies looking to reduce the carbon footprint in their operations, Stora Enso is developing several applications from lignin, which can be used to produce carbon for battery components used in energy storage, bio-based binders and even bio-based carbon fibre for wind energy equipment. Stora Enso is investing in a pilot facility for producing bio-based carbon materials based on lignin at its Sunila Mill in Finland. Wood-based carbon can be utilized as a crucial component for batteries typically used in consumer electronics, the automotive industry and large-scale energy storage systems.

ABOUT STORA ENSO

Part of the bioeconomy, Stora Enso is a leading global provider of renewable solutions in packaging, biomaterials, wooden construction and paper. We employ some 23,000 people, and have sales in more than 50 countries. Our shares are listed on the Helsinki (STEAV, STERV) and Stockholm (STE A, STE R) stock exchanges.

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ADVANCED BIOFUELS FROM SAWMILL RESIDUE

ST1'S Cellunolix® biorefining concept is a concrete step toward commercial cellulosic ethanol production. St1 is a forerunner in technology using sawmill side products – such as sawdust and chips from softwood – in advanced ethanol production.

COVERING RENEWABLE ENERGY OBLIGATIONS

Advanced ethanol made from waste reduces CO_2 emissions by up to 90% compared to fossil fuels. Lifecycle emissions are reduced by using waste and process residues as a feedstock, and therefore zero emissions can be achieved by the feedstock. Furthermore, there is no direct or indirect change in farmland usage.

Replacing fossil fuels with renewable energy sources is inevitable. The demand for biofuels will continue to grow, thus increasing pressure on imported feedstock and fuel. Biofuel obligations and the taxation of different fuels vary from one country to another. However, the origin and method of production have a great impact on how biofuel is perceived. Advanced ethanol that is locally produced from waste and process residues clearly has a sustainable lifecycle from production to the end user.

DEMONSTRATION BIO-REFINERY UP AND RUNNING

We have built a Cellunolix® demonstration biorefinery, a first of its kind, on the Renforsin Ranta industrial estate in Kajaani, Finland. It transforms sawdust from local sources into biofuel feedstock. The annual production capacity is 10 million liters. The production process generates side products, such as lignin, which are currently used primarily to produce local electricity and heat. New applications for lignin and other products are under development. Partners are invited to test samples. The pilot plant started production of advanced ethanol in 2017.

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CARING FOR LIFE

ISKU
Since 1928

ISKU'S ISKU+ antimicrobial furniture collection is the world's first to contribute to a cleaner environment. Antimicrobial materials cut down infection routes. Proven results include reducing infections and absenteeism. The innovation uses copper, silver and antimicrobial technologies used on essential contact surfaces.

PERMANENT AND SAFE

ISKU+ options are available for the entire furniture collection of ISKU, including the novel MyFlow family. Antimicrobial efficacy doesn't decay over time. Instead, it works tirelessly over the whole lifetime of a piece of furniture. This makes it a long-term solution. Based on the ISO 22196 anti microbial standard and other key principles, ISKU+'s efficacy has been tested with certain viruses, a broad spectrum of various bacteria including antibiotic-resistant strains, mold, fungi, algae and yeast. Overall, ISKU+ antimicrobial technologies reduce microbes by as much as 99.99%.

ISKU+ has consistently tested safe and environmentally friendly. Additionally, the antimicrobial additive in use has been awarded the HACCP International Certification Mark, supporting the integrity and safety of food.

CONTINUOUS RESEARCH FOR COMPLETE SOLUTIONS

Since 2013, ISKU+ antimicrobial solutions have been researched in strong cooperation with universities, companies and institutions in a variety of fields and countries. The most notable EU-level research program, IHMEC, focuses on antimicrobial surface applications to mitigate antibiotic resistance within the construction industry. ISKU is also part of HygTech Alliance, a research and business alliance of Finnish companies with technologies for complete antimicrobial interiors.

The ISKU+ solution is trusted by multiple hospitals, schools and working environments.

ABOUT ISKU

ISKU's story has its roots in Finnish wood and traditional carpentry skills. Since 1928, ISKU has made durable, high-quality furniture designed for everyday living. The family business has opted for local production and responsible operations to ensure that it will offer its services for generations to come.

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BUSINESS
FINLAND

09.2020

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