

Welcome to a webinar hosted by ExpandFibre & 4Recycling

Before we start, please make sure that:



Your speakers are turned on



Use the mute function if you are not speaking



Introduce yourself in the Teams chat



To ask questions, please add them into the Teams chat

EXPANDFIBRE

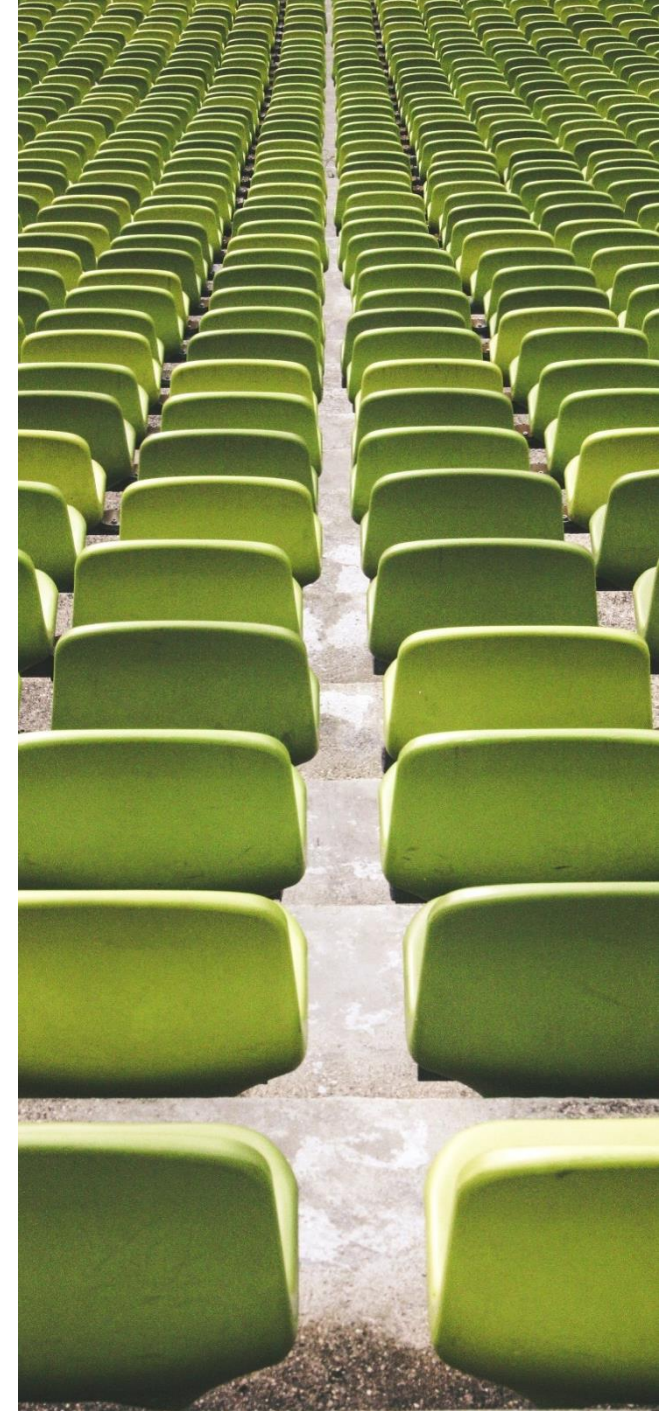
fortum



Metsä



4Recycling



Functional Biobased Packaging: Opportunities & Regulation

Webinar hosted by ExpandFibre & 4Recycling Ecosystems
February 10th, 2023 at 13:00 – 15:15 EET

ExpandFibre – Katariina Kemppainen, Metsä Spring & Risto Sormunen, Fortum
4Recycling – Aila Maijanen, CLIC Innovation

EXPANDFIBRE



Metsä



4Recycling

What is ExpandFibre?



ExpandFibre (2020-2024) is a 50 M€ R&D collaboration and an Ecosystem launched by Fortum and Metsä Group and co-funded by Business Finland. It focuses on upgrading pulp fibre, hemicellulose and lignin from renewable and sustainable sources of straw and northern wood into new bioproducts. Its ambition is to meet the growing demands for sustainable textile fibres and other added value biomaterials.

The **research and development in ExpandFibre**, aiming at producing new ground-breaking technologies and smart business concepts, is divided into **seven research themes**:



Textiles



Biocomposites



Packaging



Lignin products



Hemicellulose products



Sourcing & fractionation of straw



Other fibre products

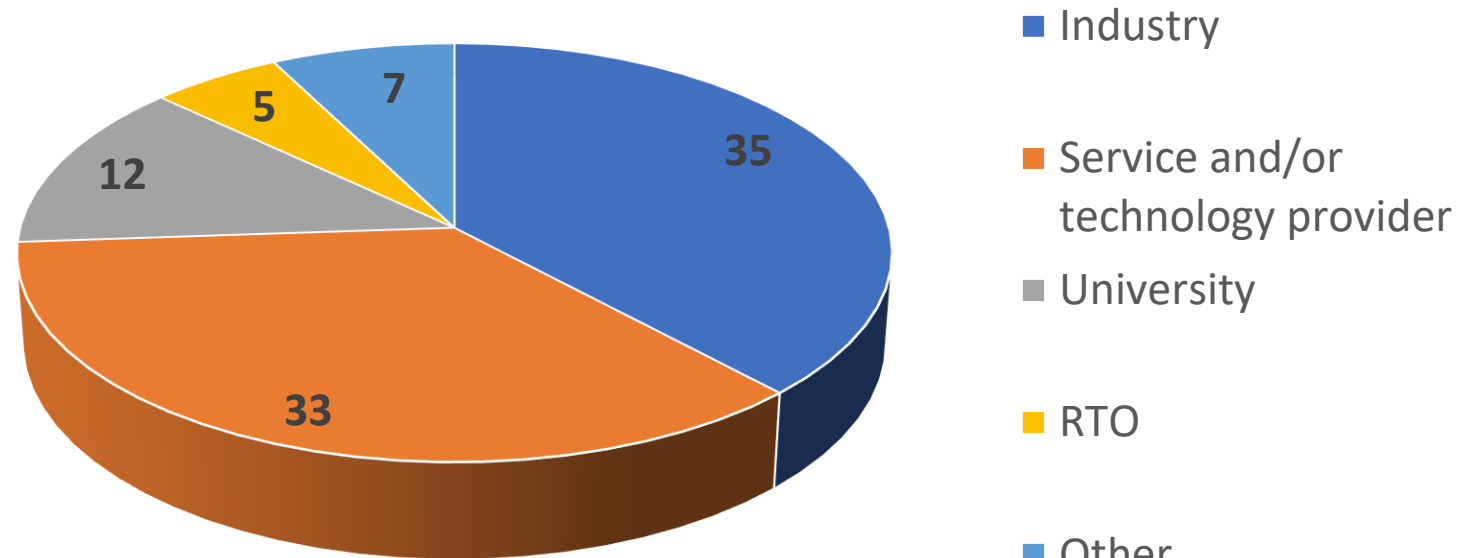


ExpandFibre invites actors in these value chains to join in building a world-leading innovation ecosystem to eventually commercialize new bioproducts and green businesses

Overview of the Ecosystem*

- **92 Ecosystem member organizations** in addition to Ecosystem hosts Fortum and Metsä Group
- Member organisation nationality:
 - **77 Finnish members (84 %)**
 - **15 international members (16 %)**
- Total company members in the Ecosystem: **65**
 - Large: **17 (26 %)**
 - SME: **48 (74 %)**

Member organizations by type:



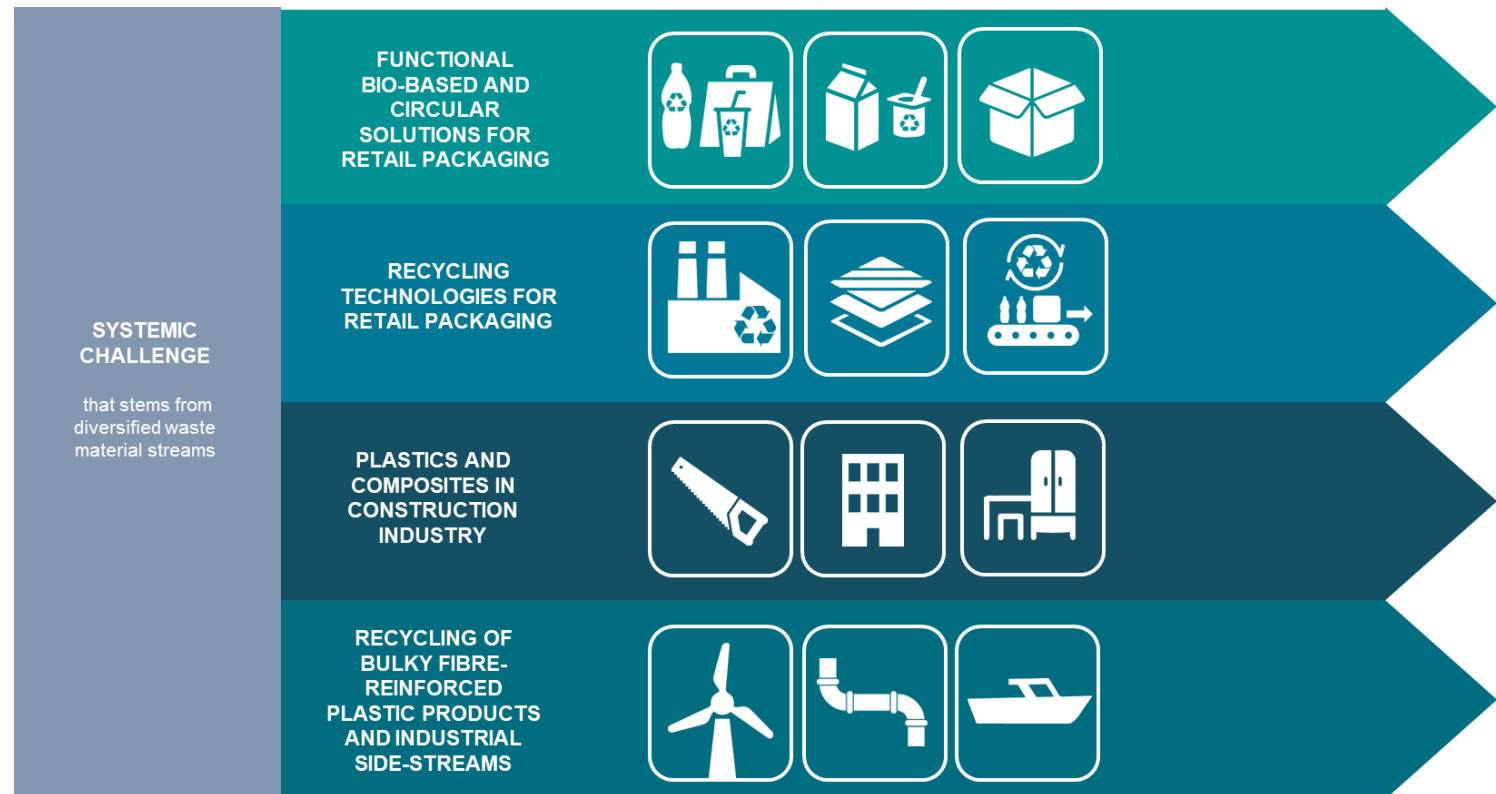


4Recycling ecosystem tackling Plastics challenge

We are building a pioneer community to develop new biobased alternatives to plastics and new plastics recycling technology and solutions.

Together we can boost positive development towards a World without waste plastics found in the nature.

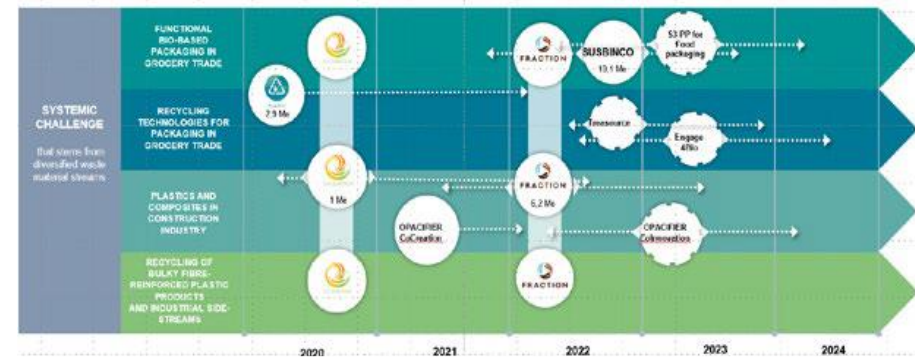
Goal: Create system-solutions to introduce a profitable but sustainable market for plastics recycling and for substitutive biobased materials.



Strategic focus areas



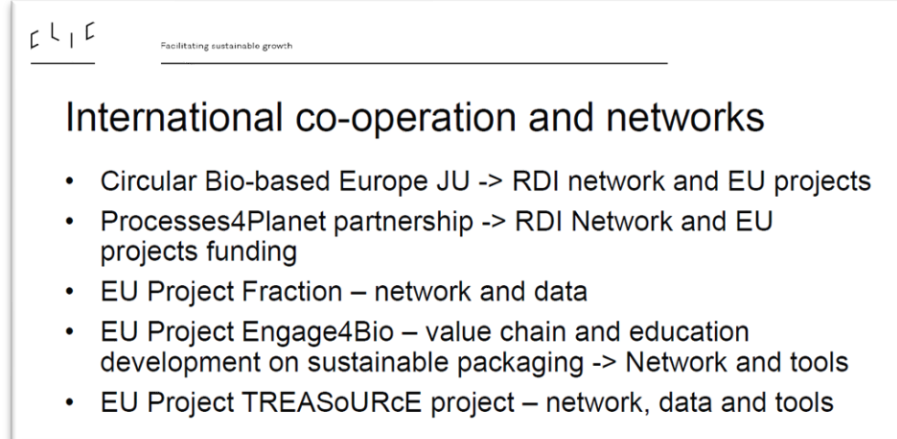
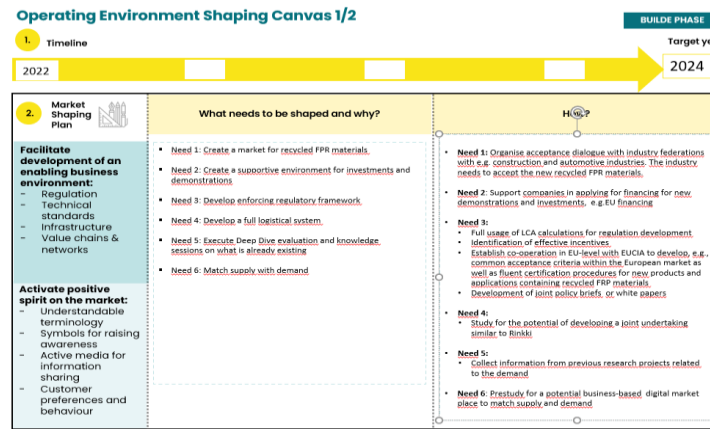
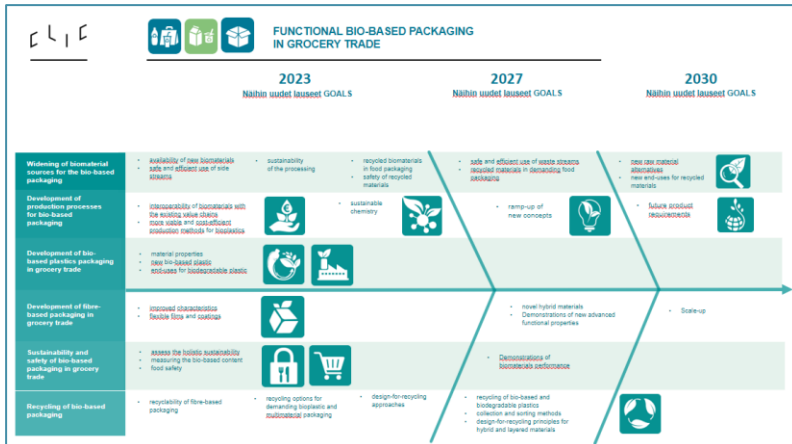
Project building



RDI Roadmaps

Market shaping

International networks



Functional Biobased Packaging: Opportunities & Regulation

Time (EET) **Friday February 10th, 2023**

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13:00 **Welcome / ExpandFibre & 4Recycling (5 min)**

- 13:05** **Panel discussion moderated by Maija Pohjakallio, VP Climate & Circular Economy at Metsä Group (60 min)**
- 5 min introductions per specialist followed by panel discussion
 - Topics of panel discussion: Retail packaging legislation, Product safety & hygiene, end user aspects
 - Specialists in the panel:
 - **Mika Lankila**, Group CEO at Pyroll
 - **Antro Säilä**, CEO at Finnish Packaging Association
 - **Aaron Vuola**, Manager, Circular Economy and Environment at Finnish Forest Industries Federation
 - **Leena Yliniemi**, Product Management Director at Metsä Board

14:05 **Coffee Break & Speed Dating (15 min)**

- 14:20** **Insights from the industry (55 min)**
- **Jaakko Pajunen**, Managing Director at Montinutra, *“Biopolymers in packaging applications”*
 - **Tommi Vuorinen**, CTO at Woodly Oy, *“New Plastic’s Route to Applications”*
 - **Essi Arola**, Head of R&D, Sustainability & Packaging at Lumene Oy, *“Lumene - Nordic leader in circular beauty”*

15:15 **End of webinar**

EXPANDFIBRE



Metsä



4Recycling

Panel discussion

Moderated by **Maija Pohjakallio**, VP Climate & Circular Economy at Metsä Group

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Functional biobased packaging Opportunities & Regulation Panel discussion

Panelists:

Mika Lankila, Pyroll

Antro Säilä, Finnish Packaging Association

Aaron Vuola, Finnish Forest Industries Federation

Leena Yliniemi, Metsä Board

Moderator:

Maija Pohjakallio, Metsä Group

February 2023

How do you define the term “functional” in functional biobased packaging?

What does it mean to you?

Packaging and Packaging Waste Regulation (PPWR)

- European Commission published a **proposal** for PPWR on 30.11.2022
- Expected entry into force in the end of 2024

- Main aims
 - **All packaging to be reusable or recyclable by 2030**
 - To implement the waste hierarchy and to set reuse as the first priority and recycling as an additional principle
 - Reduction of packaging waste: Member States shall reduce packaging waste (per capita) 5% by 2030, 10% by 2035 and 15% by 2040

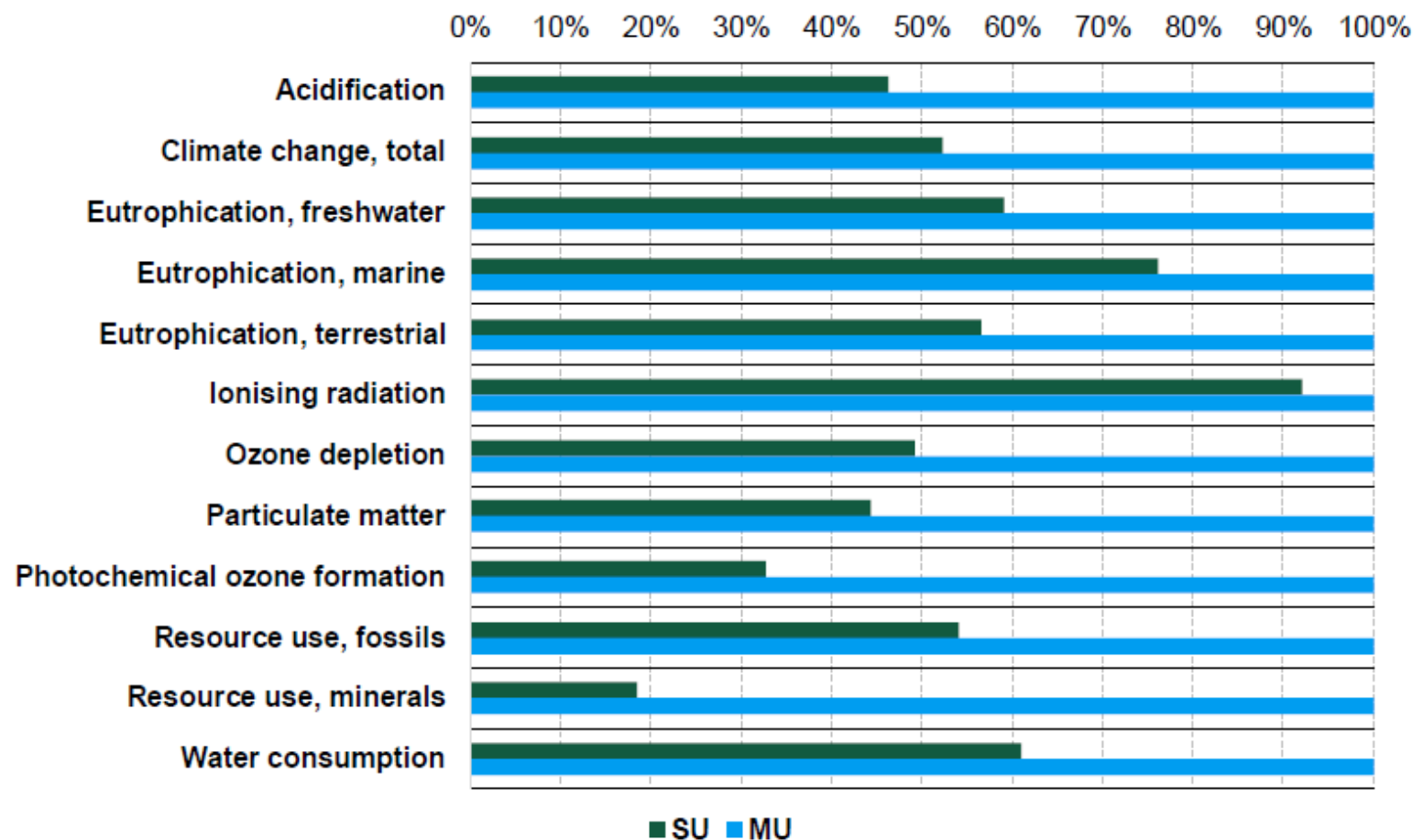


PPWR proposal –some selections

- **A ban** to place on the market **any single-use packaging for food and beverages** filled and **consumed in restaurants** (indoors and outdoors) (all materials in scope)
 - E.g., hot and cold drinks cups, plates and bowls, trays and lunchboxes
- **Mandatory reuse** requirements
 - Cold & hot beverages (HORECA) **for takeaway** 20% (2030) and 80% (2040)
 - Takeaway ready prepared food 10% (2030) and 40% (2040)
- **Mandatory recycled content** requirements for the **plastic part of packaging**
 - contact sensitive packaging **10%*** in 2030 and **50%**** in 2040 (e.g., food, pharma, cosmetics)
 - other packaging **35%** in 2030 and **65%** in 2040
 - *compostable plastic packaging is exempted*

**Name one opportunity and one challenge
for functional biobased packaging
related to the PPWR proposal**

Case example: Comparative life cycle assessment of single-use (SU) wood fibre-based and multiple-use (MU) (fossil) polypropylene tableware systems for take-away services in quick service restaurants (time span of 365 days)



Study prepared by Ramboll Italy
 Commissioned by European Paper Packaging Alliance
 ("EPPA")

Critically reviewed by experts from

- RISE Research Institutes of Sweden
- University of Campania "Luigi Vanvitelli"
- ifeu - Institut für Energie- und Umweltforschung Heidelberg gGmbH

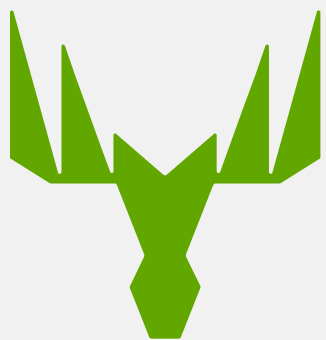
Figure 1 Results of both SU and MU systems, normalized to the highest impacts per impact category

What is the role of life cycle analysis (LCA) in

- i) comparing different packaging solutions?**
- ii) R&D of novel biobased packaging materials?**

What is your personal favorite novel functional biobased packaging solution (just launched, or in R&D/ pilot phase)? And why.

What kind of product safety benefits could be gained by functional biobased packaging materials?



Metsä

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15:15 **End of webinar**

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4Recycling

Coffee break & random dates

- **5 min break:** Put yourself on mute and go get a cup of coffee and refresh for 5 min. When you return, you will be moved to a “breakout room”
- **10 min “random group dates”:** You will be randomly assigned to a “breakout room” where you can get to know like-minded people a little bit better and discuss on today’s topic!
- Remember to turn on your cameras & mics – also remember to turn both off when returning to main event!

Possible conversation points:

Introduce yourself & your organization

What sparked your interest to join today’s event?

How do you see the use of biomaterials in functional packaging solutions in general?

What are the biggest challenges / opportunities for biomaterials in various functional packaging solutions?

Insights from the industry

- **Jaakko Pajunen**, Managing Director at Montinutra: “Biopolymers in packaging applications”
- **Tommi Vuorinen**, CTO at Woodly Oy: “New Plastic’s Route to Applications”
- **Essi Arola**, Head of R&D, Sustainability & Packaging at Lumene Oy: “Lumene - Nordic leader in circular beauty”

Thank you for joining us today!

Any feedback to the organisers of this event?

Please get in touch with the Programme Managers:

- **ExpandFibre** - Katariina Kemppainen (Metsä Spring) & Risto Sormunen (Fortum)
- **4Recycling** - Aila Maijanen (CLIC Innovation)

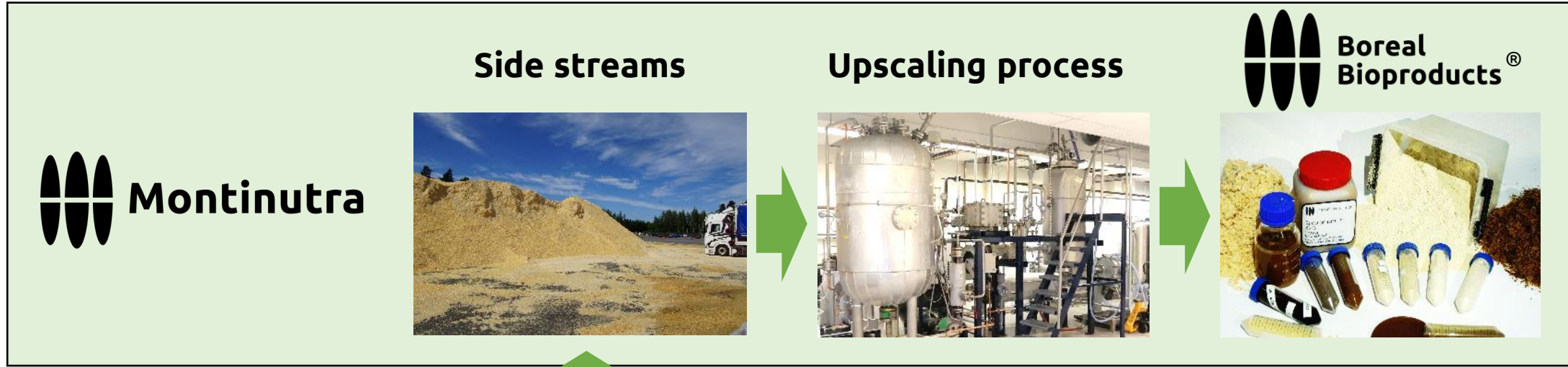


Montinutra

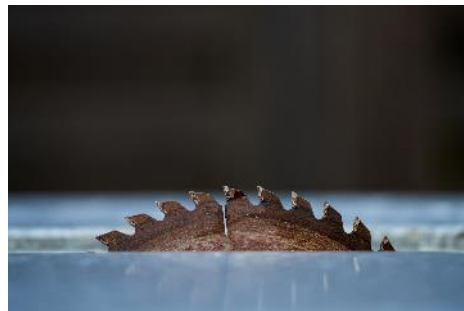
Biopolymers from biomass in packaging applications

**Expand Fibre
February 2023**

Montinutra upcycles plant based side streams from scalable and secured raw material sources



Certified forests



Saw / Pulp mill

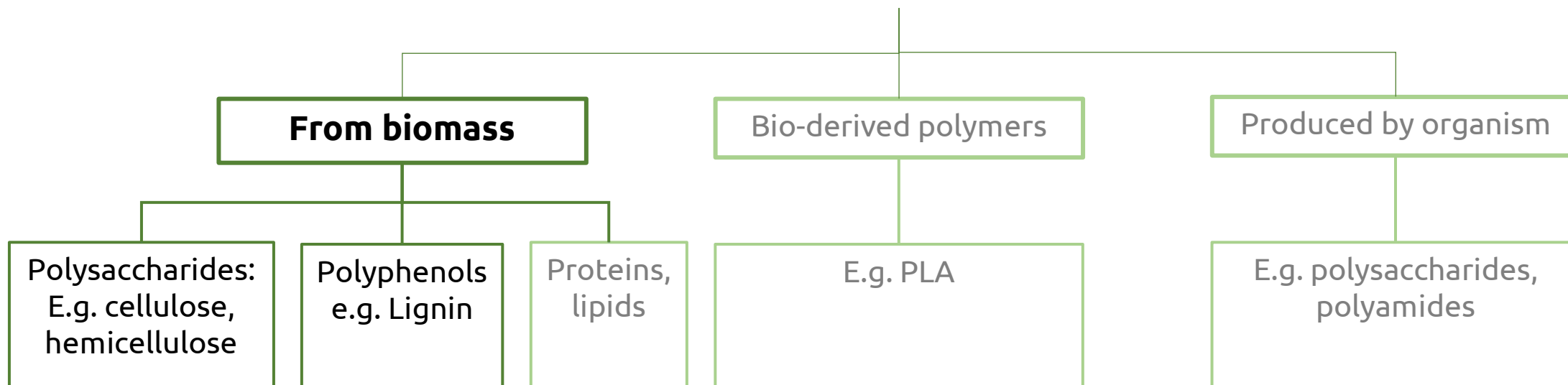


Forest products

Industry partner



Biopolymers



Cost effective, proven and zero waste process based pressurized hot water extraction and fractionation



INPUTS

Industrial side streams:
sawdust ("micro chips"),
bark

Utilities integration at
industrial site



PROCESSING

Pressurized hot water
extraction

Separation, Purification

No chemical
modification

Closed water cycle,
energy recovery



OUTPUTS

SpruceSugar

SpruceLigno

SpruceFiber

SpruceRoad

Bioenergy

Water

TRADEMARK



**Boreal
Bioproducts®**



Biopolymers from biomass

- The chemistry of the isolated components vary depending on the raw-material source and way of isolation
- No “rule of thumb” that certain type of components could always be used in a certain way, e.g. all lignins do not act alike
- Biopolymers make potential components in coatings, films, composites, nanocomposites



Hemicellulose polysaccharides

- + Water soluble
- + Tunable properties
- + Non-toxic
- + Biodegradable
- + Filmformer, oil and air barrier
- + Emulsifiers/dispersants
 - Dispersion coating
- Brittle films, poor mechanical strength
 - Complemented or modified approaches
- Sensitive towards moisture
 - Improvable water barrier properties



Lignins

- + Antioxidant
- + UV-absorbing
 - Excellent UV-blocking and radical scavenging
- + Increases hydrophobicity
- + Polyphenols with antimicrobial properties

- Processability: challenging solubility, high viscosity
- Colour
 - Nanoparticles to mitigate with



SUSBINCO-Sustainable binders and coatings

Project presentation
4Recycling-ExpandFibre joint webinar
10th Feb 2023

SUSBINCO consortium

Business Finland

01.09.2021-30.11.2023

Total budget: ~10 million €

18 Partners:

11 industries; 7 research organisations

>50 researchers

UPM **BIOFORE**
BEYOND FOSSILS



MetsäBoard



TEKNOS

MIRKA



Montinutra



Åbo Akademi
University

**UNIVERSITY
OF OULU**

VTT



UNIVERSITY OF
EASTERN FINLAND



LUT
University



Luke
NATURAL RESOURCES
INSTITUTE FINLAND



Tampere University

CH
POLYMERS

METGEN



CH
BIOFORCE

Valmet

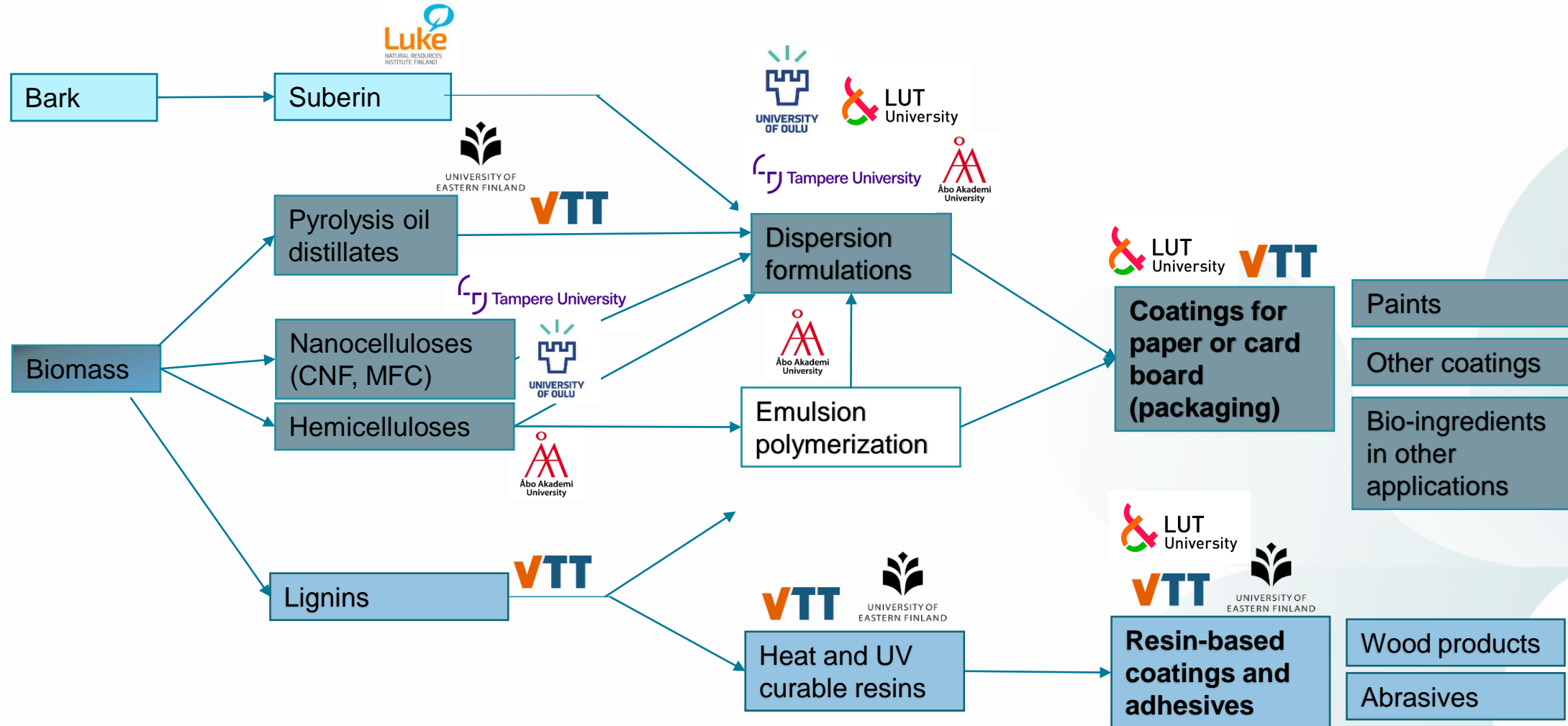


Brightplus

New to market biobased binder alternatives, coating materials and approaches that are focused on coating and barrier applications.

- Preferably wood-based alternatives (non-food competing) with limited amount of chemical modifications.
- Product performance, raw material availability and applicability i.e. technical and economical feasibility.
- Ecodesign aspects (e.g. biodegradability, recyclability, LCA)

Industry driven new materials further developed with research partners



Ingredients of the future from the residues of today.

Please contact:

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Jaakko.Pajunen@montinutra.com
+358 44 34 35 162

Mrs. Ann-Sofie Fonsen, Development Director
Ann-Sofie.Fonsen@montinutra.com
+358 44 55 30 995



New Plastic's Route to Applications

10.2.2023
ExpandFibre & 4Recycling joint webinar

Tommi Vuorinen, CTO
Woodly Ltd

An aerial photograph of a dense, lush green forest. The trees are packed closely together, creating a textured canopy of various shades of green. The lighting is soft, highlighting the tops of the trees. Overlaid on the center of the image is the text 'World without plastics' in white, with a thin teal horizontal line striking through it.

~~World without plastics~~

Plastic without fossil origin

Woody is plastic – and that is a very good thing.

Global plastics production is expected to experience considerable growth over the next decades

More than
9 billion tons
of plastic materials
produced since
1950's

All the plastics
produced annually,
about **1 %**
(**2.1 million tons**)
are bioplastics

Plastic waste in EU
25 million tons

More than **60 %**
(**16 million tons**)
of plastic waste
comes from
packaging...

... but only **40 %**
of that packaging
is recycled



Plastic cannot be replaced,
nor does it need to be replaced. We will
never live in a world without plastic.

We can **redesign plastic** to
retain the benefits it provides while
reducing its environmental impact.

Plastic waste problem is hard to be solved,
but we believe there is a future without
waste by increasing **recycling**.

Woodly Ltd

Finland based material technology company
developing wood-based bioplastic called
Woodly® material

Founded in 2011, employees 10 persons

First commercial packaging application based
on Woodly® material launched in 2020

Business model is based on selling Woodly®
granulate and licensing IPR



REDESIGNING PLASTICS

A close-up photograph of a person's hand holding a large quantity of small, white, irregularly shaped granules. The granules appear to be made of a wood-cellulose based plastic. The background is dark and out of focus.

Woodly® material is entirely new kind of carbon neutral plastic based on wood-cellulose

Carbon-neutral

Does not contain conventional plastic

Food contact approved and safe to use

Not biodegradable or compostable

Designed to be recyclable

1

Reduces dependency on fossil feedstock

- Main raw material is wood-based cellulose from FSC certified forests
- Bio-based content 40 – 60 % (TÜV Austria Certificate)
- Targeting to increase the bio-based content in our material

2

Solution to tackle climate change

- Carbon-neutral
- Life Cycle Assessment (LCA) by Pöyry (AFRY) in accordance with ISO14040 and ISO14044

3

Supports brand's core messages on sustainability

Third party consumer studies have been done with more than 400 consumers: "Woodly can increase the consumers likelihood of purchase, preference and the willingness-to-pay."

4

Drop-in granulate

- No capital investments needed for manufacturing of the end products
- Can be easily scaled up

5

Processing efficiency equal to fossil-based plastic

- Can be processed in higher temperatures and with faster speeds than other bio-based or biodegradable materials

6

End-of-life

- Can be detected with NIR (near-infrared) technique and separated from the plastic waste stream
- Can be reprocessed at least five times with no change in properties

Product launches



HKScan



K Group, Pirkka label



VihreäKeiju



St1 HelmiSimpukka,
R-kioski, AVECRA (VR Group)



Treston

Product pilots



ELPLAST (zipper)



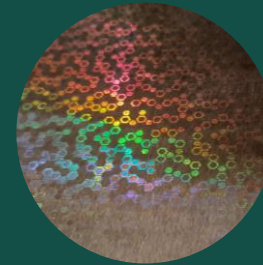
Black Moda (textile packs)



Orthex (storage boxes)



Anonymous (3D printing)



Anonymous (optical hologram)

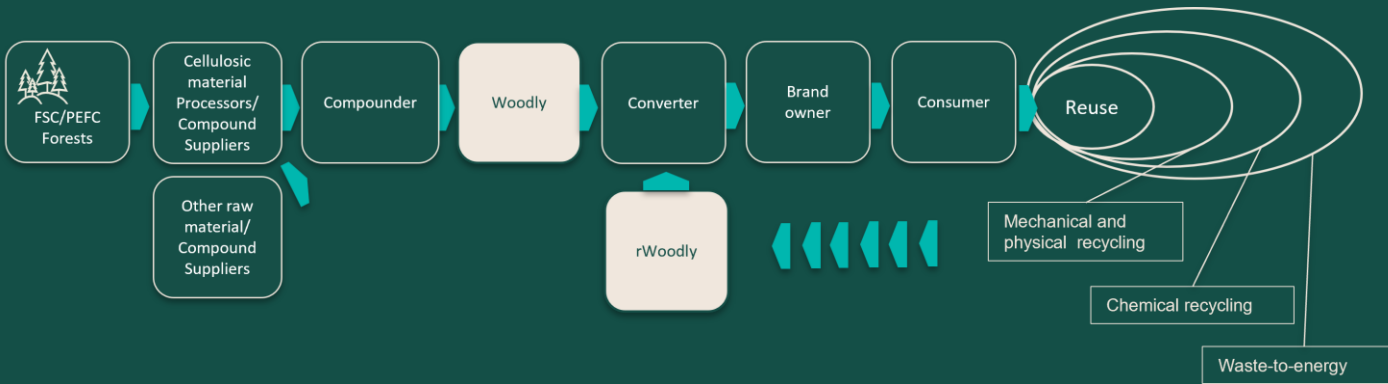
Circular economy concepts are essential part of Woodyly's value chain

Reuse
Durable consumer goods made from Woodyly suitable for decades of use

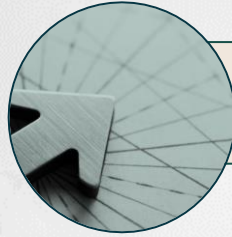
Mechanical recycling
Woodyly can be easily separated using NIR sensors and endures several cycles of recycling very well and new products can be made from recycled Woodyly. Includes collection, separation, grinding, melting, washing, regranulation.

Chemical recycling
Via gasification mixed plastics and Woodyly can be turned into syngas that then is used to make methanol or hydrocarbons and further to produce feedstock for petrochemicals.

Waste-to-energy
When incinerated for energy, the emissions from burning are 70 % lower compared to conventional fossil plastics.



NIR = near infrared
Woodyly is not biodegradable or compostable



Net Positive
Strategy

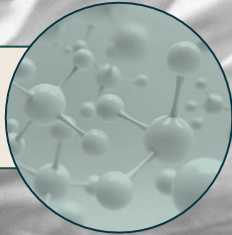


Renewal of
LCA

Sustainability
Areas
for
Development



Sustainable
Supply Chain



Increase
Bio-Content



Collaboration
with Partners



Thank You!

LUMENE – NORDIC LEADER IN CIRCULAR BEAUTY

**ESSI AROLA
HEAD OF R&D, PACKAGING AND SUSTAINABILITY
LUMENE OY**

LUMENE GROUP AT A GLANCE

COMPANY FACTS

53 years of rich history

€77,4M in 2022

~300 employees

~13,500 sqm production facility
in Espoo, Finland

MARKET PRESENCE

Homeland markets
Finland, Sweden



Strategic growth markets
UK, Norway, Denmark,
Travel Retail



Other / Opportunistic
US, China,
Distributor markets in EE



OFFICE LOCATIONS

HQ Espoo
All functions and factory

Stockholm
Scandinavian sales and marketing

London
New markets and ecom

Tallinn
Distributor markets

Boston, USA
US operations

BUSINESS SECTORS % OF GROUP SALES 2022

SKINCARE
(46%)



FACE MAKEUP
(27%)



COLOUR COSMETICS
(10%)



HAIRCARE
(12%)



PRODUCT RANGES

NORDIC HYDRA [LÄHDE]
Intense Hydration



NORDIC-C [VALO]
Glow and Hydration



NORDIC BLOOM [LUMO]
Anti-wrinkle and Firm
Anti-wrinkle and Revitalise



NORDIC AGELESS [AJATON]
Complete rejuvenation for all
key signs of ageing



ARCTIC CARE [ARKTIS]
Moisture and comfort for
sensitive skin



INVISIBLE ILLUMINATION
Skincare-infused makeup for a
truly luminous
Nordic glow



FOUNDATIONS



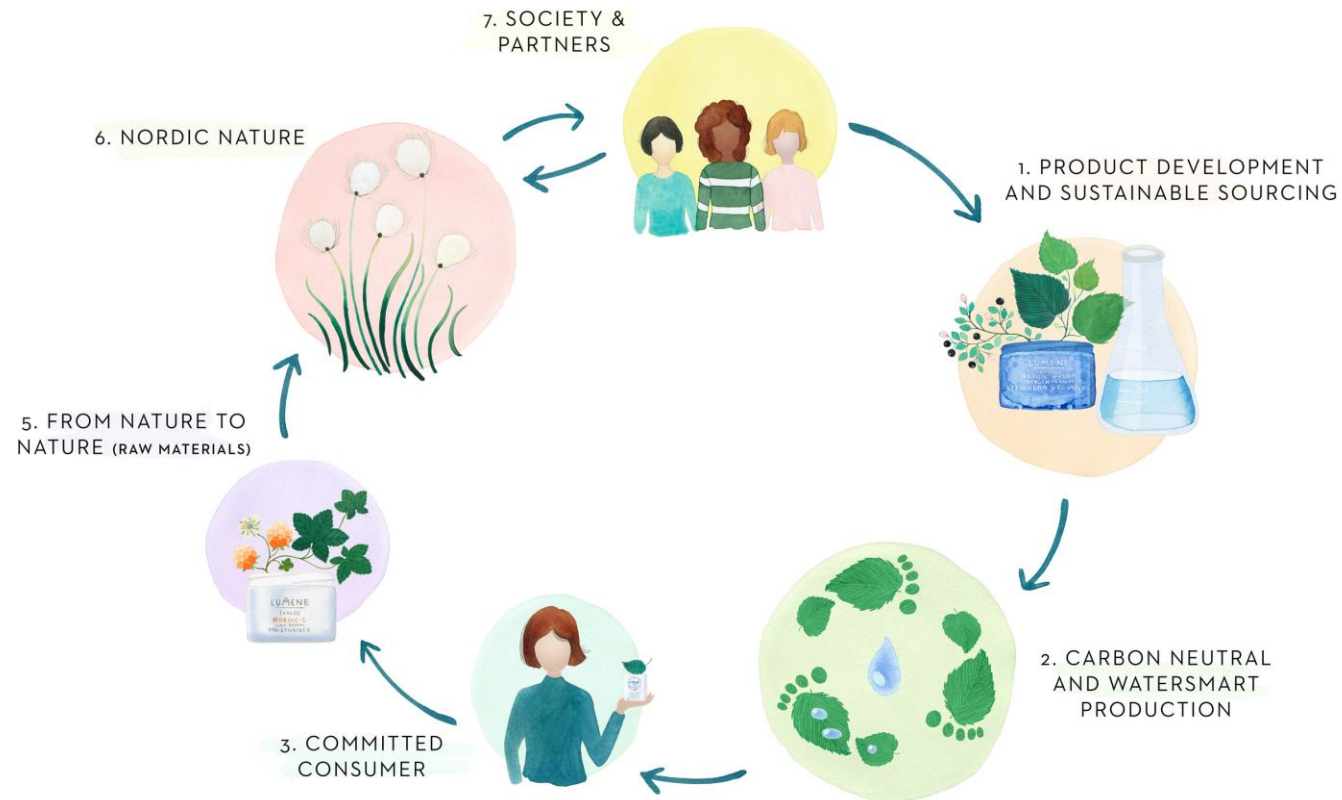
COLOUR COSMETICS



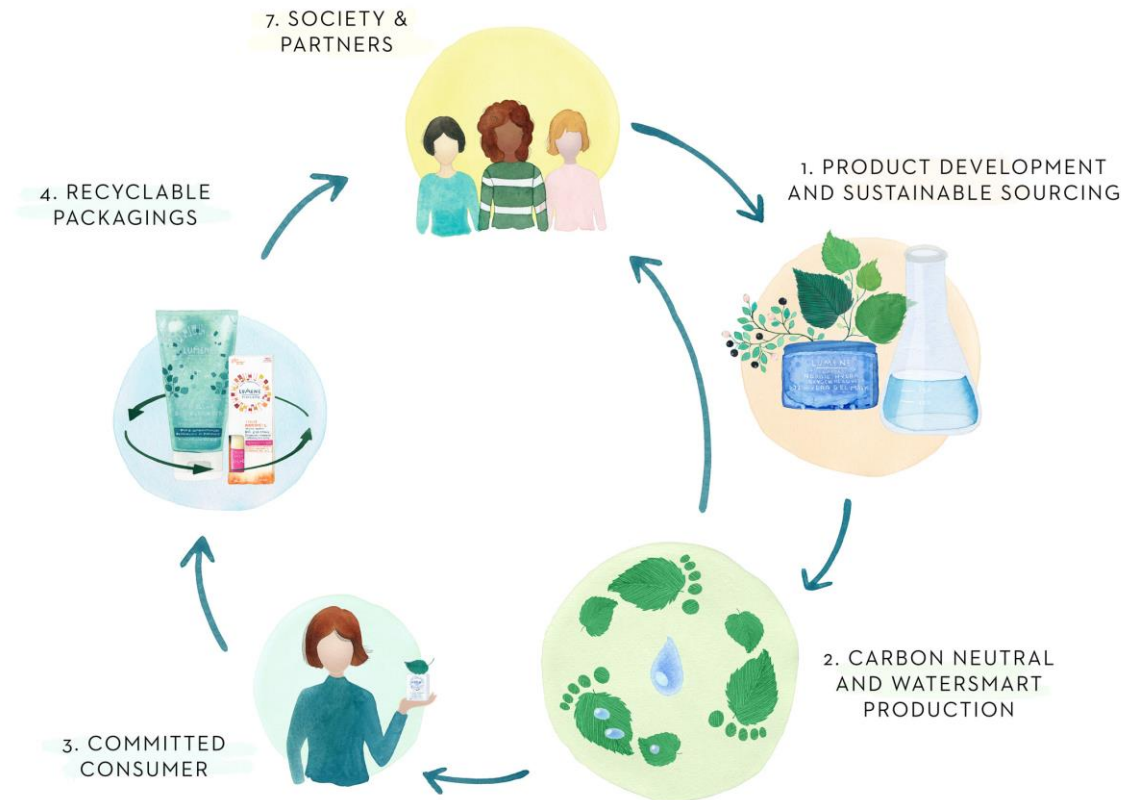
ECO-DESIGNING PRODUCTS

LUMENE Group has a fully comprehensive approach towards the circular economy. Our goal is to create a sustainable portfolio in accordance with circular economy principles.

BIOLOGICAL CYCLE



TECHNICAL CYCLE



5 RS FOR RESPONSIBLE PACKAGING DEVELOPEMENT

Elements to consider for more sustainable packaging and minimising the environmental impact of LUMENE packaging.



PACKAGING SUSTAINABILITY TARGETS FOR 2025

1



USE LESS MATERIALS

20% of less plastic in LUMENE packaging by 2025 (compared to year 2018).

REDUCE

2



RECYCLABLE PACKAGING

Maximize the recyclability of all LUMENE packaging. Make strategical skin care packaging 100% recyclable by 2025.

RECYCLABLE

3



PLASTIC PACKAGING

80% of plastic packaging is made of recycled plastic or renewable raw materials (bio-based, biodegradable material) by 2025.

RECYCLED & RENEWABLE

4



FOLDING BOXES

Only FSC® certified carton board by 2025.

5



SHIPPERS

FSC® material in shippers

LUMENE

REDUCE THE USE OF MATERIALS

With cosmetics formulations having water inside, plastics are often the most convenient packaging material. There the objective is to reduce amount of materials and study new material innovations.



LIGHT-WEIGHT RECYCLABLE SKINCARE MOISTURIZER JAR

45% LESS MATERIAL

Our new jar is lighter – only 44 grams (vs. old jar up to 92 grams).

40 TONS LESS PLASTIC A YEAR

1 million jars annually = 40 tons less plastic each year



SULAPAC CO-OPERATION WITH BEST-SELLING LUMENE MOISTURIZERS

One of the first cosmetics companies in the world with water-containing face creams in a biobased packaging made out of biodegradable material.

REPLACE PLASTICS

With waterless products traditional plastic packaging can be replaced with fibre packaging options.



RECYCLABLE AND REUSABLE POWDER CASE

33% LESS MATERIAL

4000 kgs of less plastic due to light-weighting

3200 kgs of less virgin plastic due to recycled plastic

7 TONS LESS VIRGIN PLASTIC A YEAR



1st generation



2nd generation

POWDERS COME WITH REFILL OPTION

The refills are packed into a fibre-based packaging.

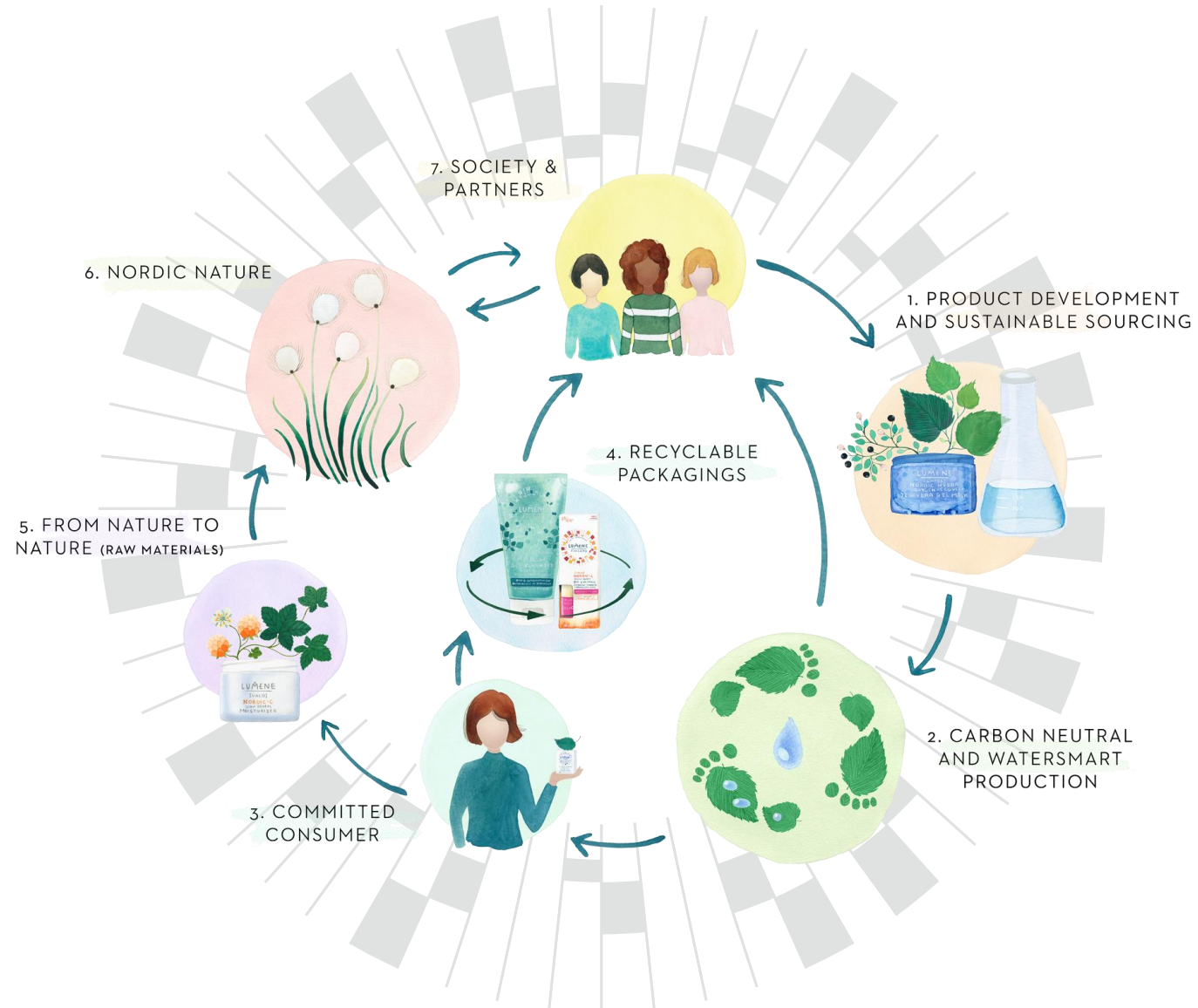
Refill packaging (2nd generation) is 65% less material compared to buying a powder in new compact packaging.

CONCLUSIONS

LUMENE is a Nordic pioneer in circular beauty – and has been for over two decades. Yet, we are still continuously increasing our efforts to create more circular beauty with our partners.

Good functional network is essential; when developing circular systems.

Our circular beauty journey continues...



A photograph of a birch forest with the text "THANK YOU!" overlaid in the center. The trees are tall and thin, with white bark and dark lenticels. The ground is covered in green grass and small plants. The background is a dense forest of green trees.

THANK YOU !