EXPANDFIBRE

Accelerating the development of sustainable bioproducts

LigninReSurf
Tuesday, February 6th, 2024

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fortum Metsä

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
- Other fibre & wood 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

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www expandfibre.com

in ExpandFibre

ExpandFibre Programmes & Ecosystem

ExpandFibre Ecosystem aims at developing novel bioproducts with a reduced environmental impact

Vision	**New bioproducts based on sustainable biomass contribute significantly to the reduction of the negative environmental impact of our everyday lives**
Mission	**ExpandFibre Ecosystem strives to meet the growing demand for sustainable bioproducts by developing ground-breaking materials and technologies and smart business concepts**

Short term objectives (2020-2024)

- Build knowledge-based **competitive advantage** among the ecosystem members
- Create/strengthen **test-beds for piloting** and proof-of-concept validations in the theme areas
- **Identify and fill in gaps** in the R&D landscape within ExpandFibre themes
- Create a thriving **business-driven innovation ecosystem for new biomass-based textile fibres**

Long-term objectives (2030 and beyond)

- Provide markets with new bioproducts that have **less than 20% of the carbon footprint** of the current products
- **Bring new revenue to ecosystem partners** through the increasing production and sale of new value-added bioproducts and technologies.
- Significantly **increase investments** into biomass-based value chains

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ExpandFibre Ecosystem R&D&I focus points on the road towards the Vision 2030

Straw and wood as raw materials

Textiles

- New, sustainable textile fibres for wearable textiles and nonwovens
- Staple fibre analytics and performance testing
- New staple fibre applications and post-treatment technologies
- Recycling and traceability
- Business models to speed up global market entries

Biocomposites

- Raw material processing and converting
- Material properties
- Recycling and end-of-life
- Biocomposites containing fibres and lignin
- All-cellulose composites & natural fibre polymer composites
- Additive chemistry

Packaging

- New pulp-based plastic-replacing packaging solutions
- Tools and processes for designing sustainable packaging
- Barriers and binders based on natural polymers

Lignin products

- Lignin fractionation for material applications
- Lignin as functional ingredient for thermosetting resins as well as for thermoplastics and bio-composites
- Lignin dispersants
- Novel methods for lignin functionalization

Hemicellulose products

- Hemicellulosic sugar refining and separation
- Xylose, pentoses and furfural as industrial ingredients and platform chemicals
- Polymeric hemicellulose as industrial ingredients and platform chemicals

Sourcing & fractionation

- Sustainable, low emission agricultural residue supply chains and networks
- New fractionation technologies for processing of agro-residual and woody raw materials
- Process side-stream utilization

Other fibre and wood products

- New materials based on pulp fibres and wood for high-volume applications
- Novel chemistry for pulp fibre and wood modification
- Functional structures including hybrid materials
- Advanced 3D and 4D processing methods
- Fibre and specialty cellulose products from pulp, including MFC, MCC and chemically modified cellulose

Cross-cutting topics

- Replacing plastics and fossil-based materials
- Digitalisation & measuring
- Emerging technologies
- Sustainability assessment
- Design for circularity
- Piloting and test-beds for new applications
- Following regulatory environment

Vision for 2030

- **Investments** in commercial production of new bioproducts (textile fibres, biocomposites, other bioproducts, etc.)
- New bioproducts available to the markets with significantly **lower carbon footprint**
- Sales and/or out-licensing of **new technologies** related to new bioproducts
- **Professionals** trained for new bioproduct businesses
- **Sustainability awareness** increased throughout the value chains

ExpandFibre connects to multiple R&D initiatives by Fortum and Metsä Group

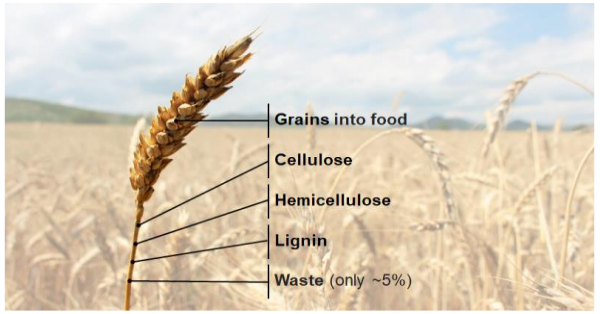
Collaboration with Chempolis and construction of the biorefinery in India (Fortum)

Demonstration of sustainable straw-based textiles (Fortum)

Development of novel materials utilising recycled plastics (Fortum)

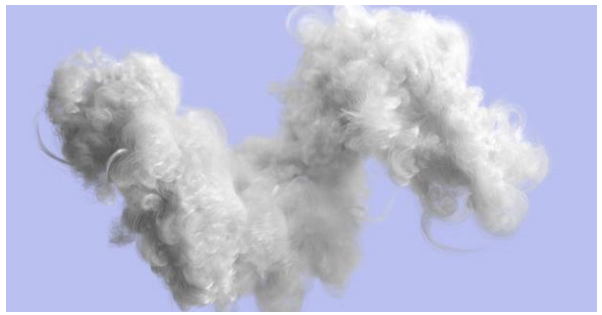
Development of a new 3D fibre-based packaging product to replace plastics (Metsä)

Sourcing & fractionation	Lignin	Hemicellulose	Textiles	Biocomposites	Packaging	Other fibre & wood products



High material efficiency through fractionation (Fortum)

Converting hemicellulose and lignin into value-added products (Fortum)



Development of sustainable textile fibre from paper-grade pulp (Metsä)

Establishment of Paperboard and Packaging Excellence Centre in Äänekoski (Metsä)

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Metsä
Valmet
LAB University of Applied Sciences
kemira
UNIVERSITY OF OULU
SULZER
SC GRAND
Sustainable Textile
Lignopure
SciTech Service
Lignum
TEKNOS
lignovations
OSMOS
IDEA DESIGN ASSEMBLY DELIVERY
LIXEA
Measurlabs
KiiLTO
FIBROBOTICS
LOUNAIS-SUOMEN JÄTEHUOLTO
KCL
piloting knowledge
GREEN INDUSTRY PARK
KOTA
Semantum
BRINTER
Printing Life One Layer At A Time
CH
BIOFORCE
COATS
Elastopoli Oy
CONENOR
FIBERX
FINLAND
LIGNEASY
Mega Cellulose
Fraunhofer ICT
Fraunhofer WKI
AEP polymers
Lumir
Texon
MEGATREX
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SYNBIO POWERLABS
Brightplus
TOUCHPOINT
Sustainable Workwear
INNOVESTOR
3DTECH
Tampere University
Tampere University of Applied Sciences
Natural Indigo
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WOODLY
PATTERNSFROM FINLAND agency
Boreal Bioproducts
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SWECO
innomost.
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FINITED FIBER
GRADIA
NIMAR
FILTER
MIRKA
PLAFCO FIBERTECH
JYVÄSKYLÄN YLIOPISTO
UNIVERSITY OF JYVÄSKYLÄ
DIENES
GloCell
Åbo Akademi
FOCUS
ON DESIGN
NORDIC BIOPRODUCTS GROUP
METGEN
TURKU AMK
TURKU UNIVERSITY OF APPLIED SCIENCES
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Technological Institute for children's products & leisure
RES TER
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SAALASTI
WOOD KPLUS
VTT
Luke
LUONNONVARAKESKUS
COVEROSS
More life

ExpandFibre Project Ecosystem

FinnFiberColor

LigninRESurf

ValCel

SynBioPro

SynBio Power House

ECOLABNET

FoN

Carbon neutrality empowered by handprint

NUMOBIO

HydBondCell

SUSBINCO

4everPack

telavalue

BIOPROT

FOLD

HiPer

FurBio

SmartRecovery

SUSTAFIT
Sustainable fit-for-purpose nonwovens

Bio C C Value
High-value carbons from agricultural sidestreams

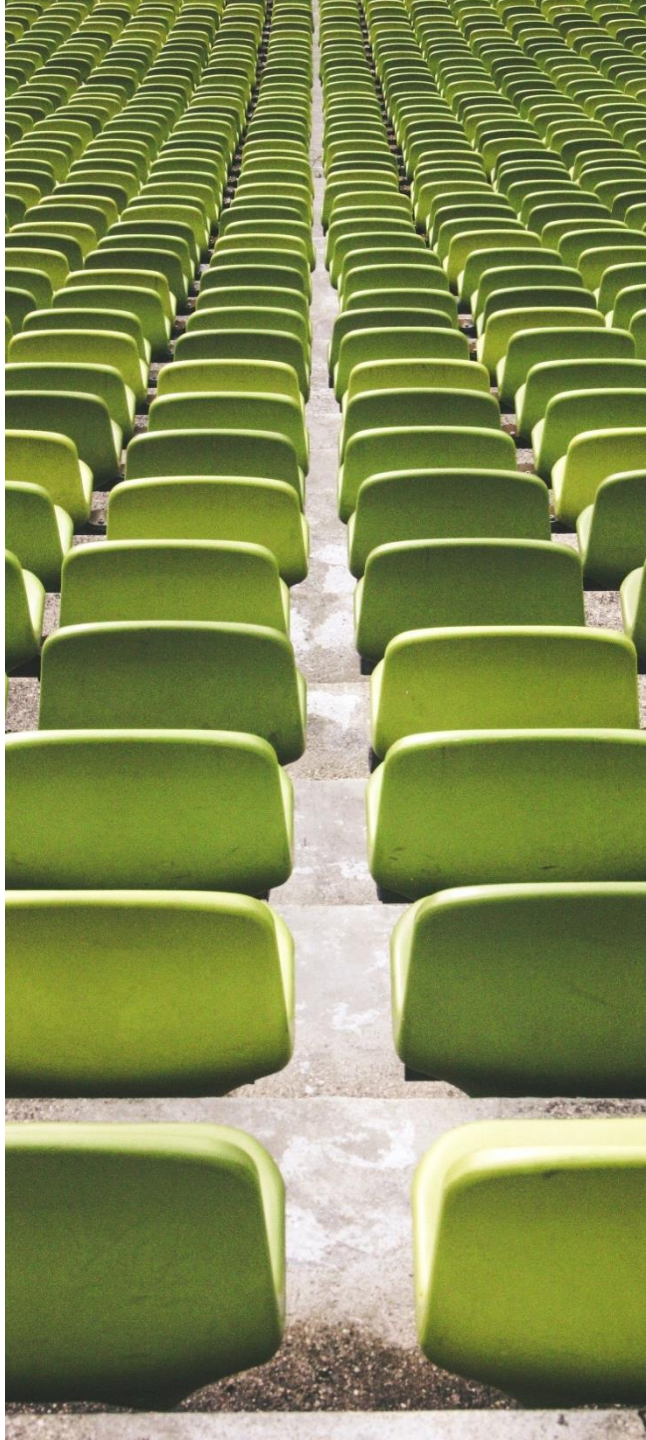
F3 Films For Future

CERAFIM
Cellular Agriculture for Food and Materials

GRAM

SmartLagring

MAP 1_A1



ExpandFibre themes & Ecosystem projects


Textiles

FinnFiberColor

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Sustainable fit-for-purpose nonwovens


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Films For Future


Lignin products

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Sourcing & fractionation

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High-value carbons from agricultural sidestreams

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SUSTAFIT
Sustainable fit-for-purpose nonwovens


Other fibre & wood products


Hemicellulose products


Cross cutting topics

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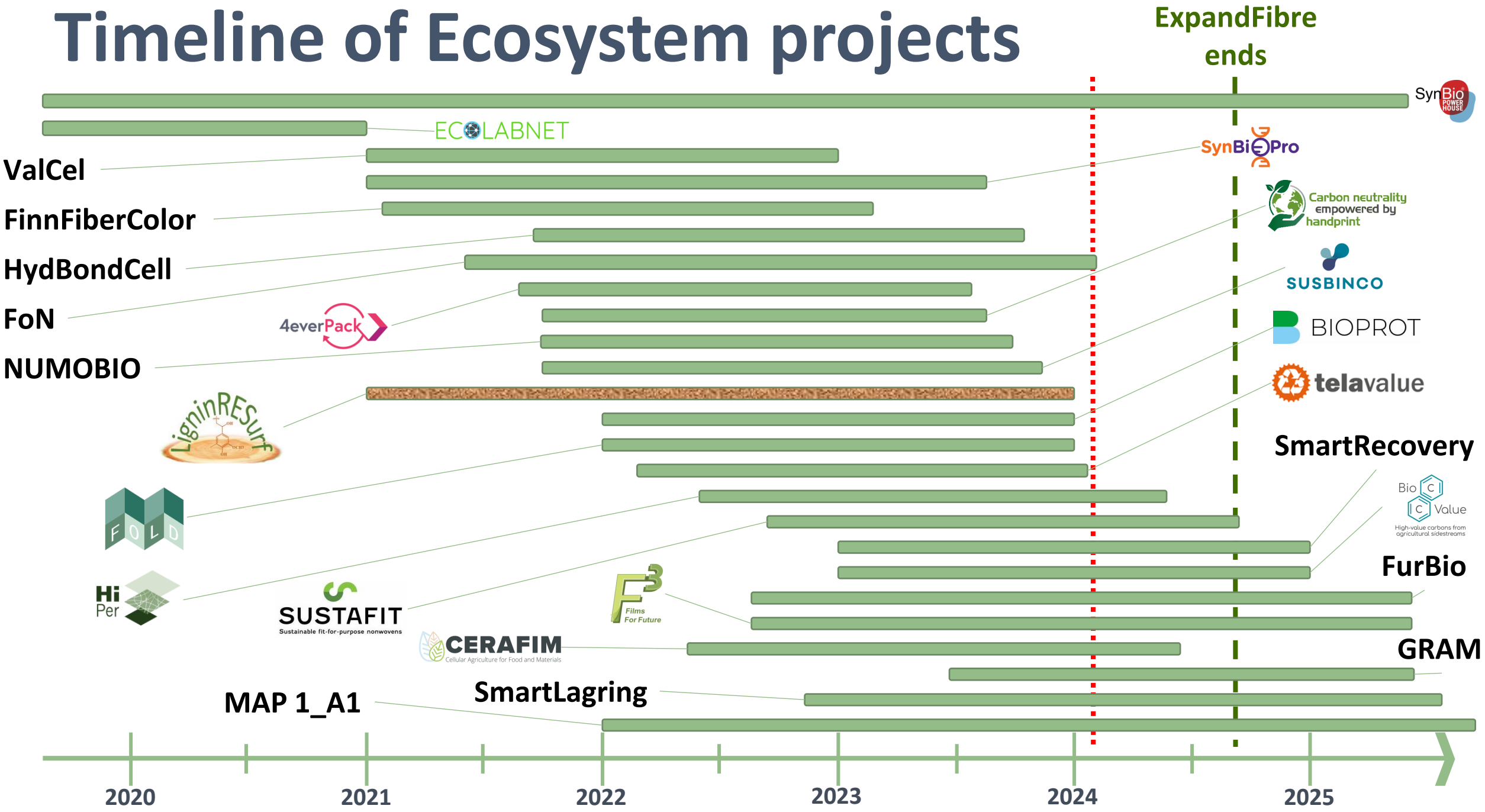
Bio C Value
High-value carbons from agricultural sidestreams

SUSTAFIT
Sustainable fit-for-purpose nonwovens

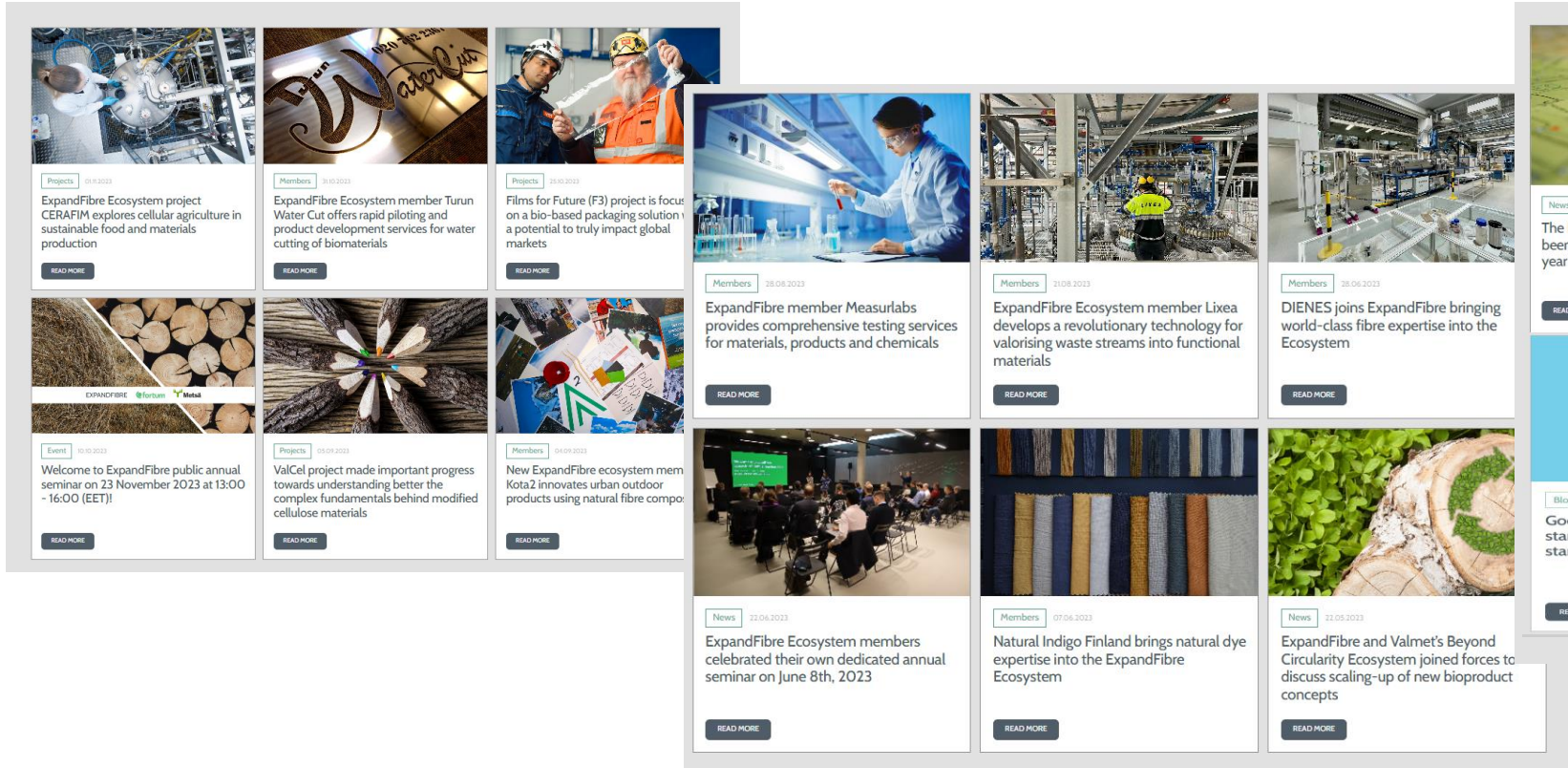
Topics studies in other ExpandFibre's lignin related ecosystem projects

- Carbonization of lignin and use in energy storage systems, biocomposites and purification processes
- Producing lignin particles with a defined morphology
- Novel analytics methods for lignin
- Use of lignin in coatings and resins
- Microbial conversion of lignin monomers
- Modification of technical lignin grades
- Lignin depolimerization for resin application

Timeline of Ecosystem projects



Over 100 stories written about the Ecosystem members and the activities on www.expandfibre.com



- New story about LigninReSurf to be published once the project has finished to disseminate among the ExpandFibre Ecosystem members & beyond

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Fortum's take aways from LigninReSurf

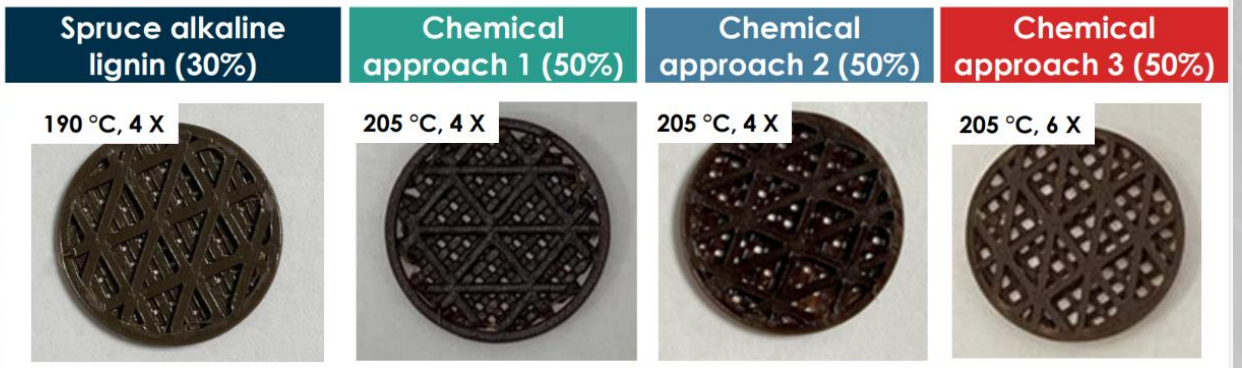
-Deep understanding on the properties of fractionated lignin from solvent vs membrane fractionation
-Good results in improving compatability of PLA-lignin complexes

-Also cellulose/lignin based aqueous dispersion barrier coating was developed and demonstrated a good result, which has potential for biobased packaging applications
-New lignin-latex complex is developed that can be used as a binder for Talc pigment in coating applications.

-Fantastic number of research publication for the project (4 pubished, 2 submitted on 6 on the way)! + theses and conferences

- Esterified lignins are good candidates for 3D printing

Brinter INVIVO 3D printer



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Join us to meet the growing demand for sustainable bioproducts – we need players from every part of the value-chain

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