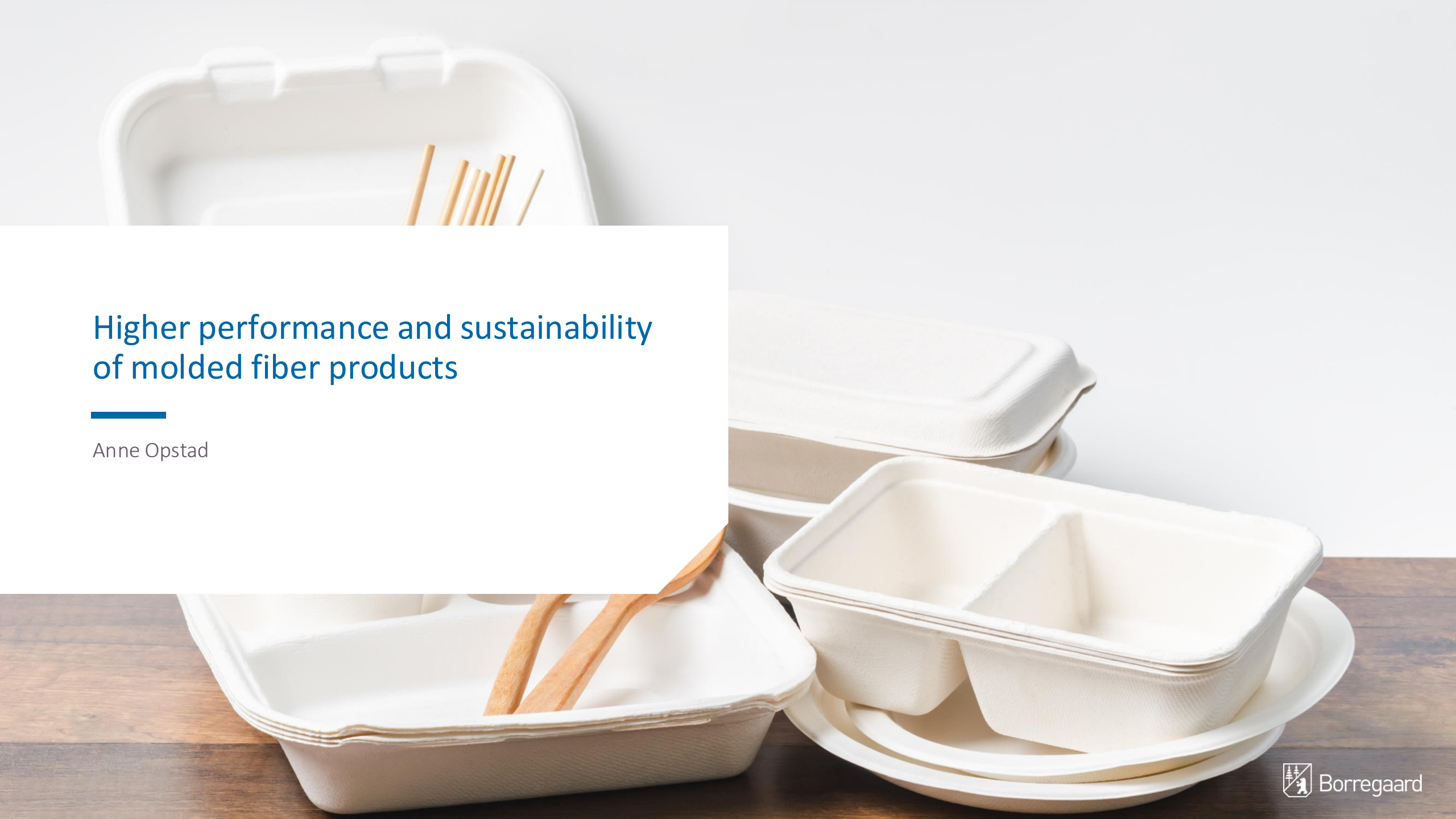
Higher performance and sustainability of molded fiber products

Anne Opstad



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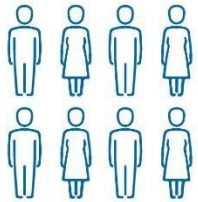
The world’s most advanced biorefinery

EMPLOYEES



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PRODUCTION

- Biopolymers
- Speciality cellulose
- Bioethanol
- Biovanillin
- Cellulose fibrils
- Fine chemicals

800 PRODUCTS

RAW MATERIAL

1 MILLION

m^3 Norway Spruce
375.000 tonnes lignin raw material

BORREGAARD IN THE WORLD

Business in
13
countries

Sales to
100
countries

Sales outside Norway
95
percent

FINANCIAL FIGURES

Turnover
7.1
billion NOK

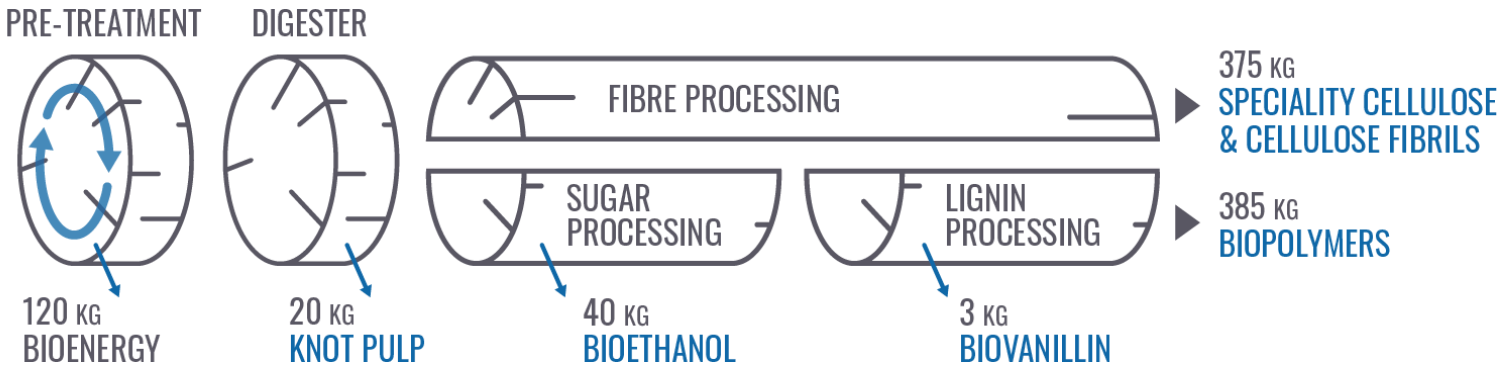
Result EBITDA
1.8
billion NOK

Investment
838
million NOK

High utilisation of raw materials

1000 KG
WOOD

94%
UTILISATION



BIOPOLYMERS
- Concrete additives
- Animal feed
- Agrochemicals
- Batteries
- Briquetting
- Soil conditioning

BIOVANILLIN
- Food
- Perfumes
- Pharmaceuticals

SPECIALITY CELLULOSE
- Construction materials
- Filters
- Inks and coatings
- Casings
- Food
- Pharma
- Personal care
- Textiles

CELLULOSE FIBRILS
- Adhesives
- Coatings
- Agricultural chemicals
- Personal care
- Home care
- Construction

BIOETHANOL
- Biofuel
- Disinfectants
- Pharmaceutical industry
- Home care
- Personal care
- Paint/varnish
- Car care

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Borregaard’s solutions

Lightweighting

- Replace plastic packaging
- Reduction in CO_2
- Less wood needed
- Less waste created

Bio-barrier

- Replace plastic and PFAS
- Compostable
- Reduction in CO_2
- Reduction of dusting

Improved barrier

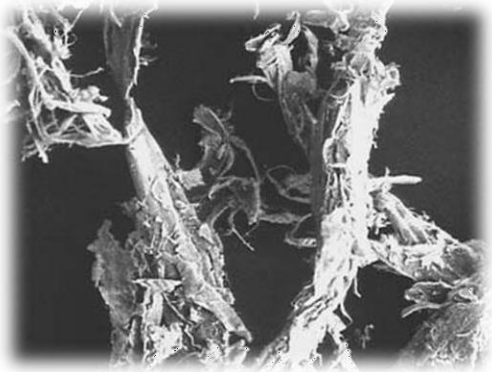
- Higher performance
- Faster process
- Less waste created
- Fulfil the current regulations

Overview of cellulose fiber and fibrils landscape

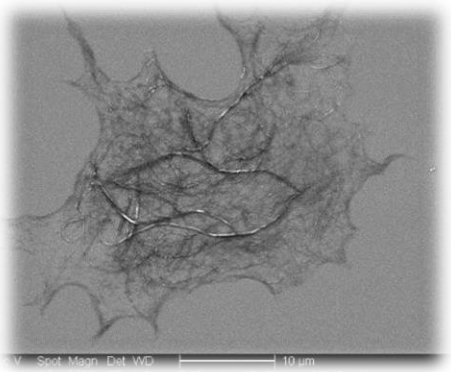
Cellulose fiber

Typically produced mechanically

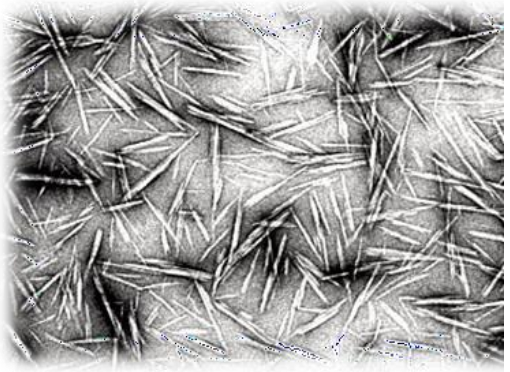
Typically produced chemically



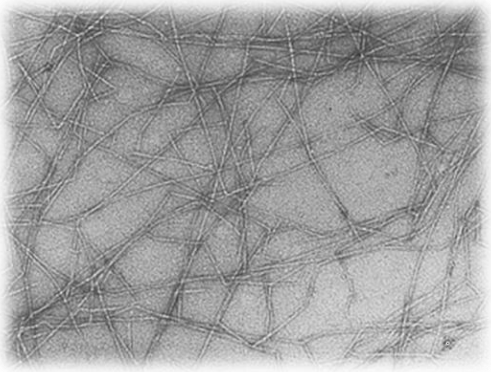
Fibrillated cellulose



Exilva (MFC)



Cellulose nanocrystals



Nanocellulose

Fibrillated celluloses

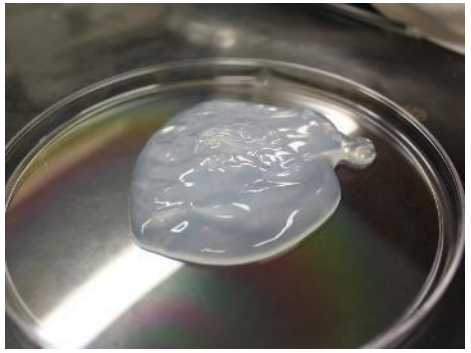
Nanocelluloses

Overview of cellulose fiber and fibrils landscape

Cellulose fiber

Fibrillated cellulose

Exilva (MFC)



Cellulose nanocrystals

Nanocellulose

Fibrillated celluloses

Nanocelluloses

What is Exilva?

Industrially available

Produced since 2016 in industrial scale (1000 MTDS)

Certified bio-based raw material

Fully bio-based, sustainable and plastic-free.
Made of wood, USDA BioPreferred®, biocide free.

Food contact approved

BfR and FDA approved

No CAPEX needed

Easy to add to existing molded fiber processes

Value of Exilva in molded fiber

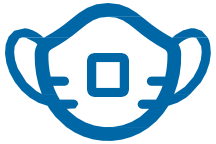
REDUCE PACKAGING WEIGHT

STRONGER PACKAGING

MEET CUSTOMER EXPECTATIONS

IMPROVE SUSTAINABILITY

INNOVATION



REDUCE DUSTING

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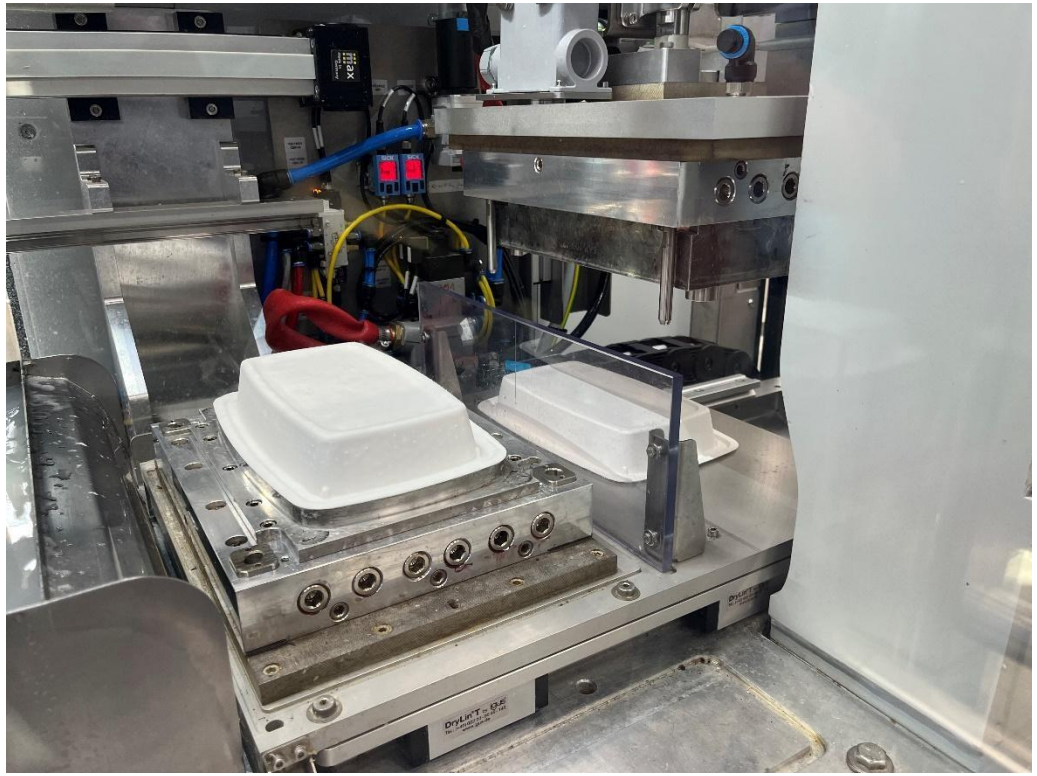
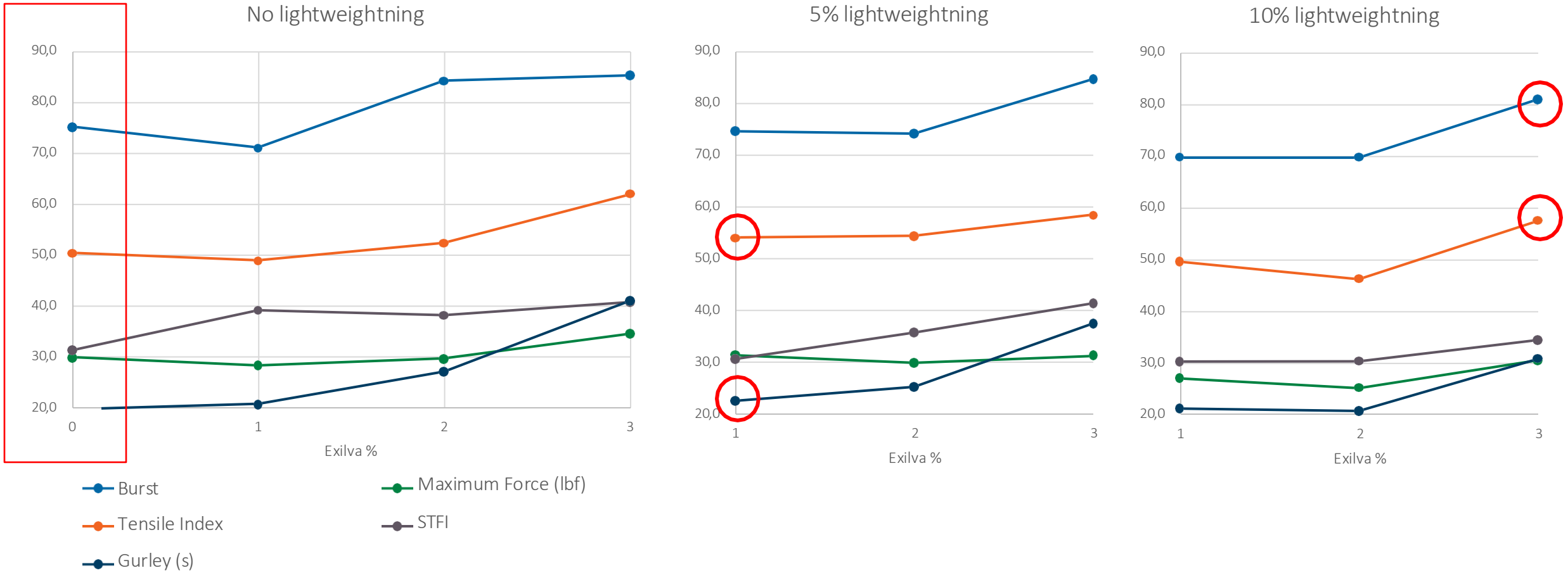
Lightweighting with Exilva

0%, 1% , 2% and 3% Exilva tested in 30/70 SW/HW

- Target weight of the tray: **20g**
- Target grammage: **637 g/m²**



Evaluation



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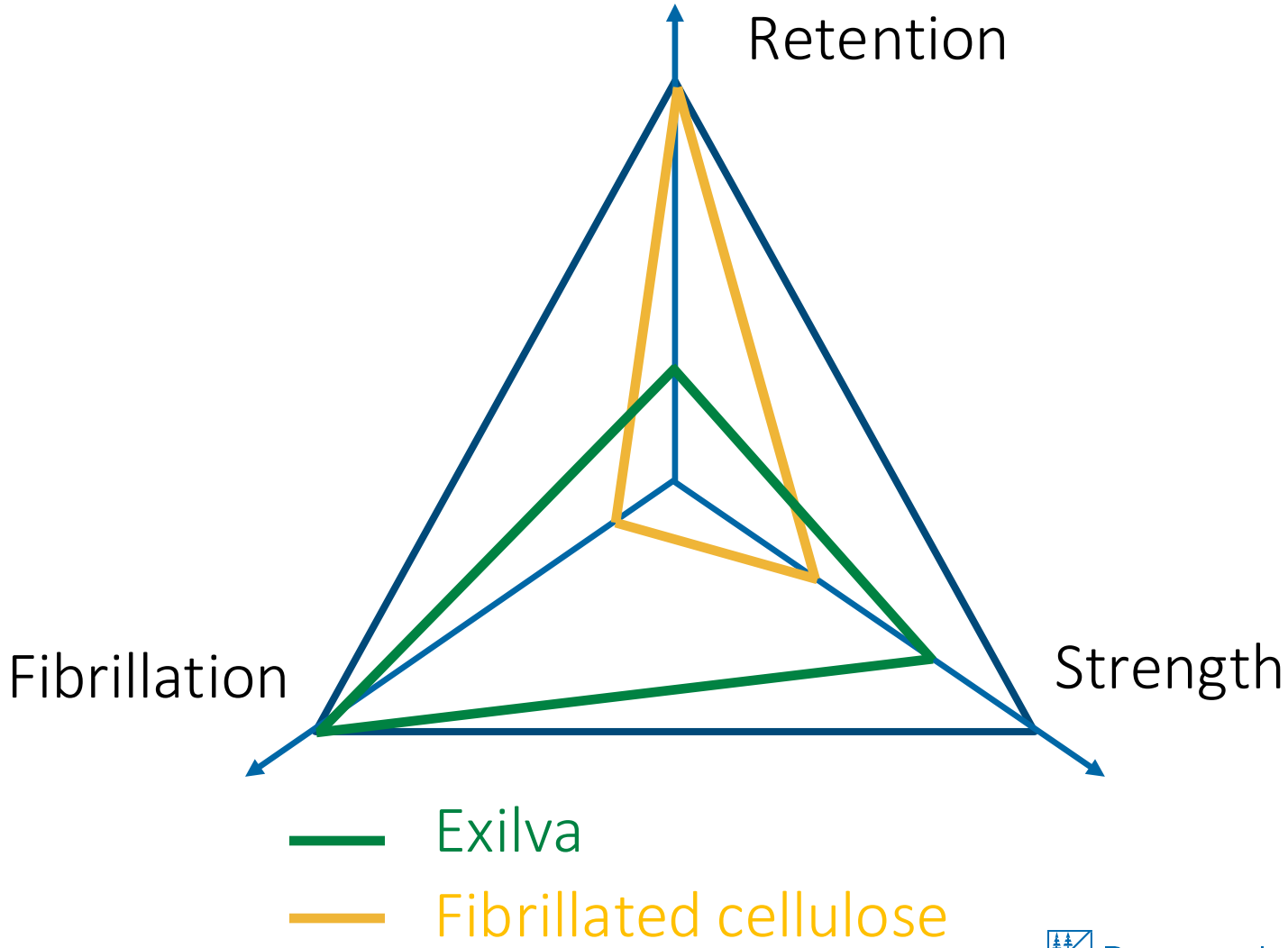
Magic triangle

- With low fibrillation degree better retention is obtained but lower strength
- High fibrillation degree results in lower retention but higher strength
- With retention aid, the optimum conditions with Exilva can be obtained



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Economic impact

Reduction in fiber consumption

Reduction in raw material costs.
Enables the use of lower quality fibres.

Reduction in CO_2

Reduced cost of carbon emissions.

Reduction in waste

Less waste means savings
for the packaging producer.

Lower transportation cost

Less weight means savings in transportation.

LIGHTWEIGHTING

Up to 10% reduction in weight
with the same performance

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Environmental impact

Reduction in wood consumption

By reducing the virgin fibre, less wood will be needed
→ Positive message for the end consumer.

Reduction in CO_2

The packaging has reduced
contribution to global warming.

Reduction in waste

Less waste created.

Recyclable

No negative impact on
recyclability of the packaging

LIGHTWEIGHTING

Up to 10% reduction in weight
with the same performance

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Improved sustainability

Reduction in CO_2

by adding Exilva that enables lightweighting

Level of lightweighting	5 %	10%
Amount of Exilva	1%	2%
Reduction in GWP	**1.9%**	**5.9%**

Reduction in wood use

due to addition of Exilva that enables lightweighting

Level of lightweighting	5 %	10%
Amount of Exilva	1%	2%
Reduction in wood use	**5%**	**10%**

Reduction in waste/transportation

as less fiber per tray means less waste and less transport emission per tray

Level of lightweighting	5 %	10%
Amount of Exilva	1%	2%
Reduction in waste	**5%**	**10%**

All numbers estimated and calculated internally based on available product carbon footprint or Ecoinvent v. 3.10 data of the respective or the most similar compound.

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The perfect solution for the development of ***more sustainable*** *molded fiber products, and for* ***meeting the performance*** *of plastic based alternatives.*

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