

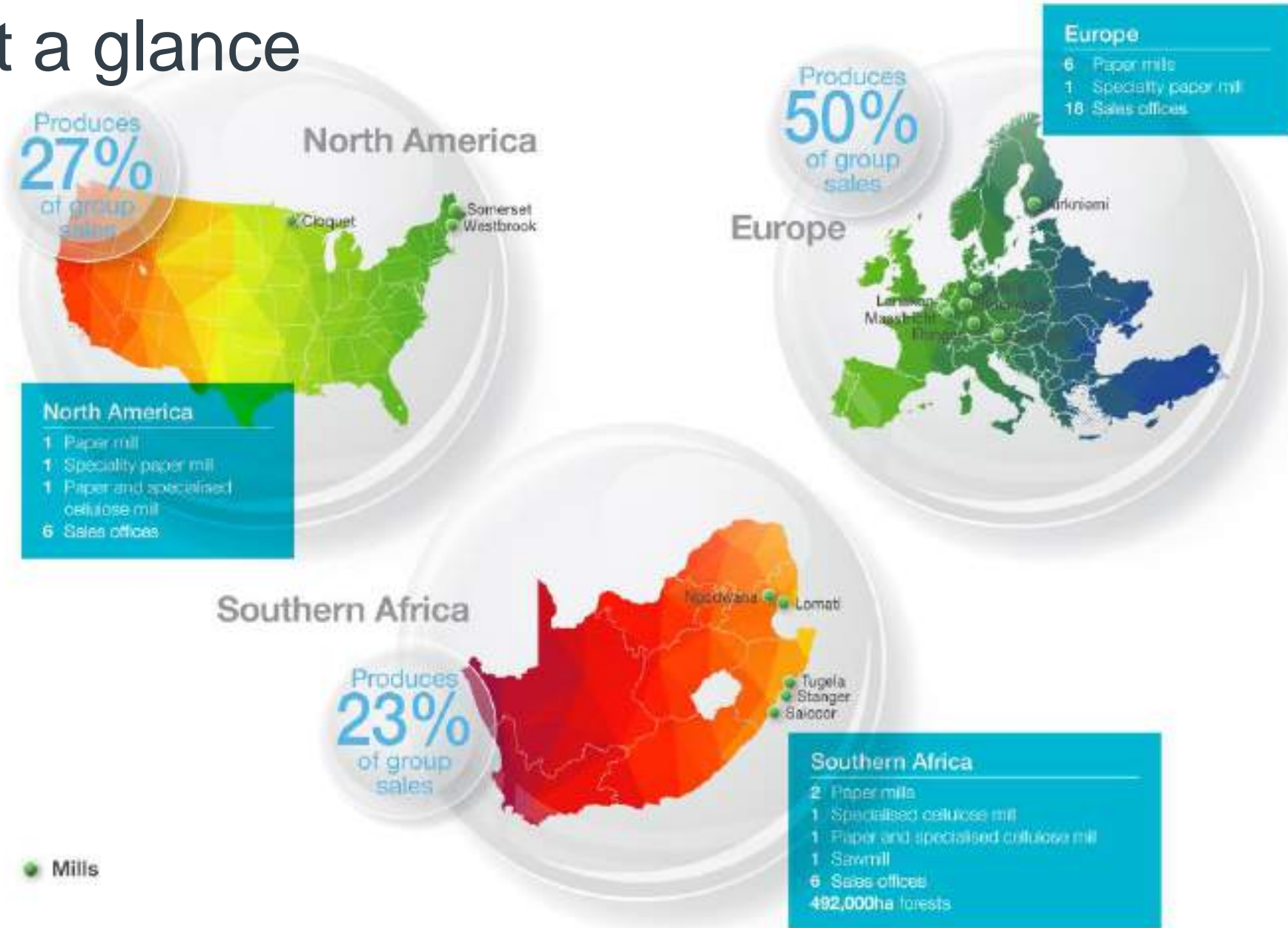
# Developing wood based biorefineries

10 December 2019



**Nikolaus Schwaiger**  
Chemical Engineer Biorefinery  
R&D Sappi Europe

# Sappi at a glance



# Sappi Europe operations

Total paper production capacity: 3.7 million tpa

## Maastricht Mill (The Netherlands)

280,000 tons coated fine and speciality paper

## Lanaken Mill (Belgium)

530,000 tons coated fine paper  
165,000 tons bleached mechanical pulp

## Stockstadt Mill (Germany)

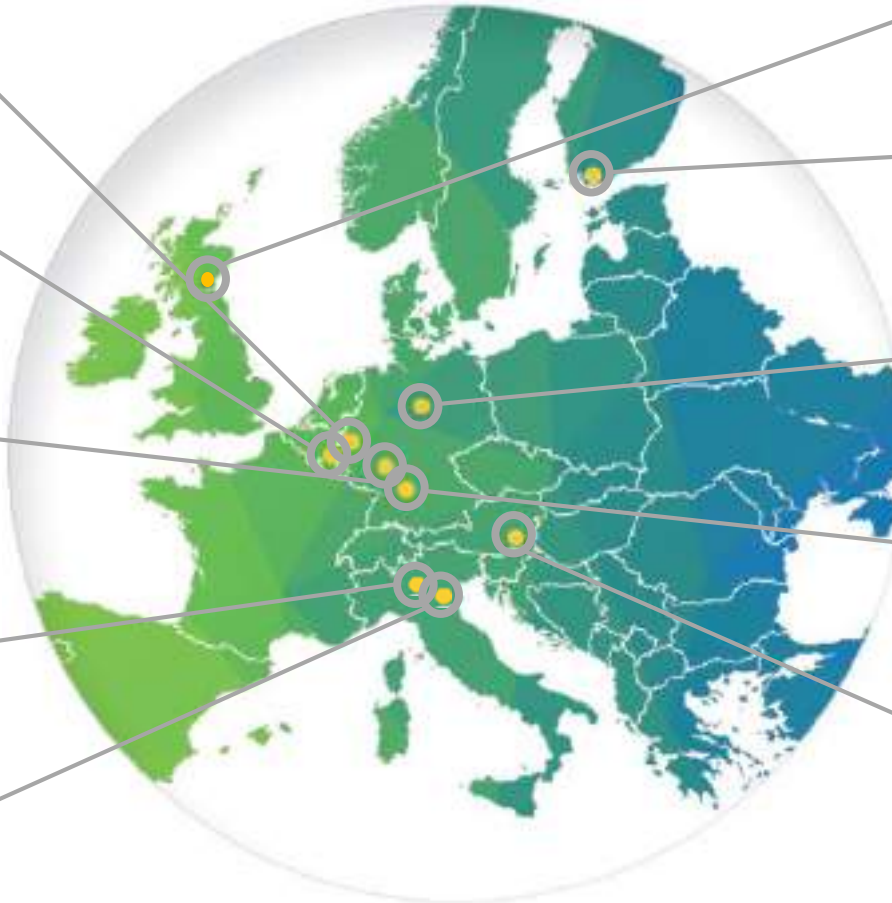
445,000 tons coated and uncoated fine paper  
145,000 tons bleached chemical pulp

## Condino Mill (Italy)

60,000 tons speciality paper

## Carmignano Mill (Italy)

100,000 tons speciality paper



## Rockwell Solutions (United Kingdom)

100 million m<sup>2</sup> coated barrier film and paper

## Kirkniemi Mill (Finland)

750,000 tons coated paper  
300,000 tons bleached mechanical pulp

## Alfeld Mill (Germany)

275,000 tons speciality paper  
120,000 tons bleached chemical pulp

## Ehingen Mill (Germany)

280,000 tons coated fine and speciality paper  
140,000 tons bleached chemical pulp

## Gratkorn Mill (Austria)

980,000 tons coated fine paper  
250,000 tons bleached chemical pulp

# Sappi at a glance

## Sappi Limited

PRODUCTION CAPACITY  
**PAPER**  
**5.56** MILLION TONS

PRODUCTION CAPACITY  
**PAPER PULP**  
**2.2** MILLION TONS



**12,500**  
 EMPLOYEES

PRODUCTION CAPACITY  
**SPECIALISED CELLULOSE**

**1.4**  
 MILLION TONS

EBITDA 2017: US \$ 785 MILLION



EXCLUDING SPECIAL ITEMS

PROFIT 2017: US \$ 338 MILLION



EXCLUDING SPECIAL ITEMS

## Sappi Europe

PAPER  
**3.7** MILLION TONS  
 PRODUCTION CAPACITY

**1.12**  
 MILLION TONS  
 PAPER PULP  
 PRODUCTION CAPACITY

**10**  
 MILLS

**14**  
 SALES OFFICES



**5,850**  
 EMPLOYEES\*

# Examples for Value Generation from Lignosulphonates

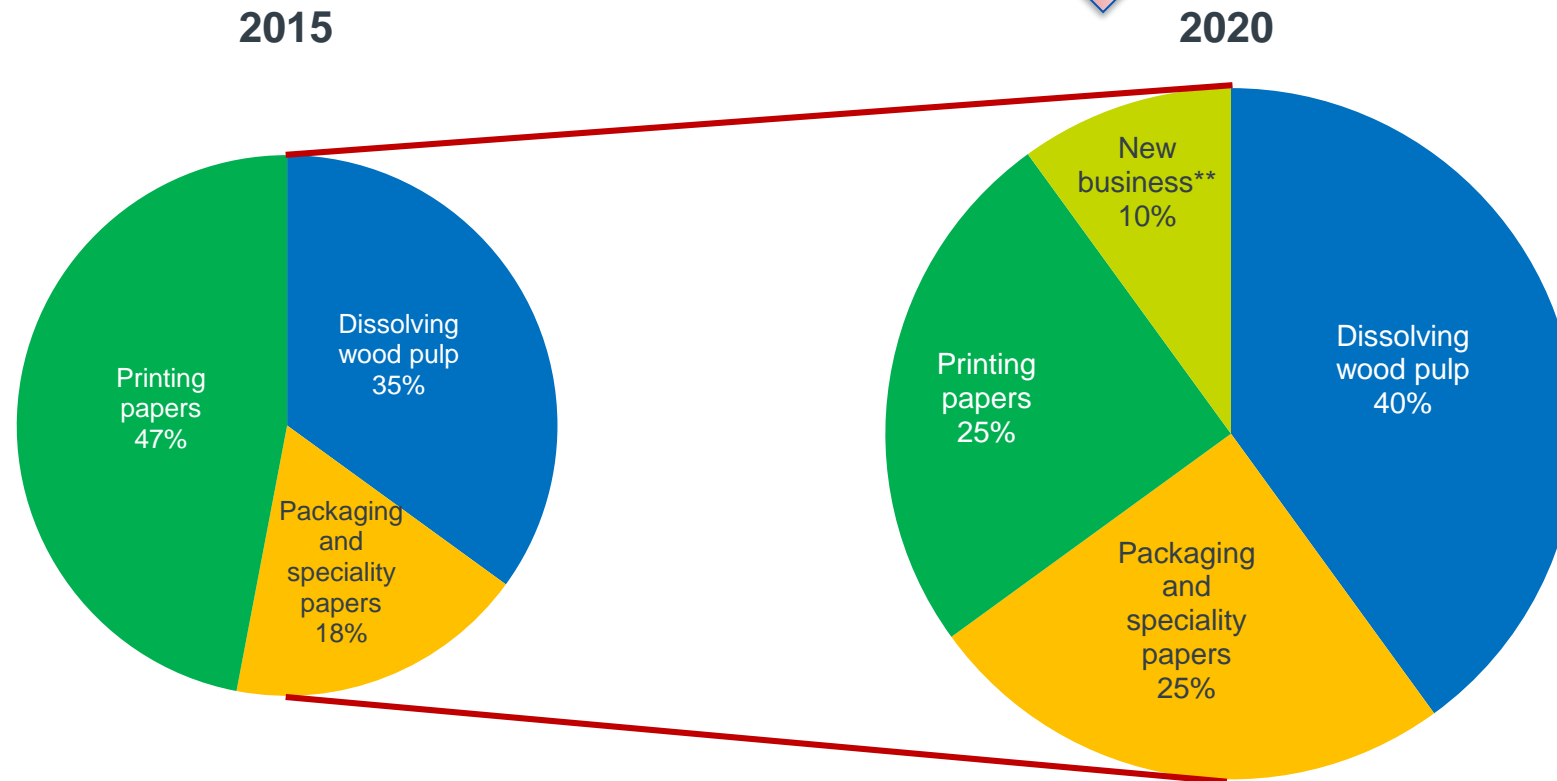
- Application areas for Sappi's lignosulphonate products (COLLEX®, HANSA®, ZEWILEX®, LIGNEX® and PERMASOL®):
  - Concrete admixtures
  - Gypsum plasterboards
  - Bricks
  - Pigment dispersions
  - Process water treatment
  - Ceramics
  - Refractory products
  - Pelletizing
  - Dust control
  - Fertilizers
  - Crop protection
  - Chipboard
- Heat produced by Sappi's Gratkorn Mill is being used for district heating:
  - Newly installed pipelines from Gratkorn to Graz
  - Heating 18,000 households in the city of Graz (Austria) every year.



# Our 2020 Vision

EBITDA\*

**Biorefinery products**



\* Earnings before interest, tax, depreciation and amortisation.

\*\* Biomaterials (eg nanocellulose), biorefinery products and bio-energy.

# Our business - Unlocking the full potential of trees

Making the most of a renewable, natural material

Managed forest



Cellulose

Hemicellulose

Lignin

End use



**Graphic papers  
Specialities and  
packaging papers**

Commercial print  
Product packaging  
Technical papers



**Dissolving  
wood pulp**

Textiles  
Pharmaceuticals  
Cellophane



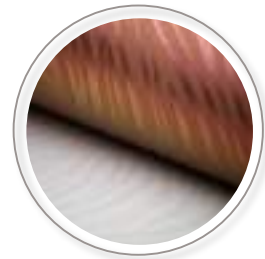
**Fibre composites**

Automotive parts  
Furniture  
Audio speakers



**Nanocellulose**

Reinforcing agent  
Control release agent  
Viscosity modifier



**Casting and release  
papers**

Textures for materials  
Functional films  
Automotive wraps



**Xylitol and chemicals  
from sugars**

Low calorie sweetener  
Toothpaste  
Recyclable plastics



**Chemicals from  
lignin**

Binding agent  
Dispersion agent  
Emulsion stabiliser

# Dissolving wood pulp

Dissolving wood pulp is produced by extracting the cellulose portion of the tree and tailoring the quality of the product to meet customer needs.

This makes DWP a hugely valuable, versatile and sustainable raw material source.

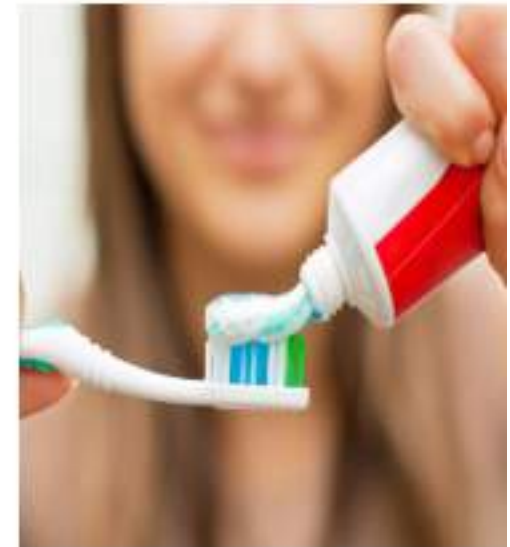
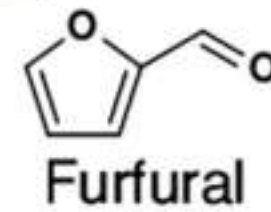
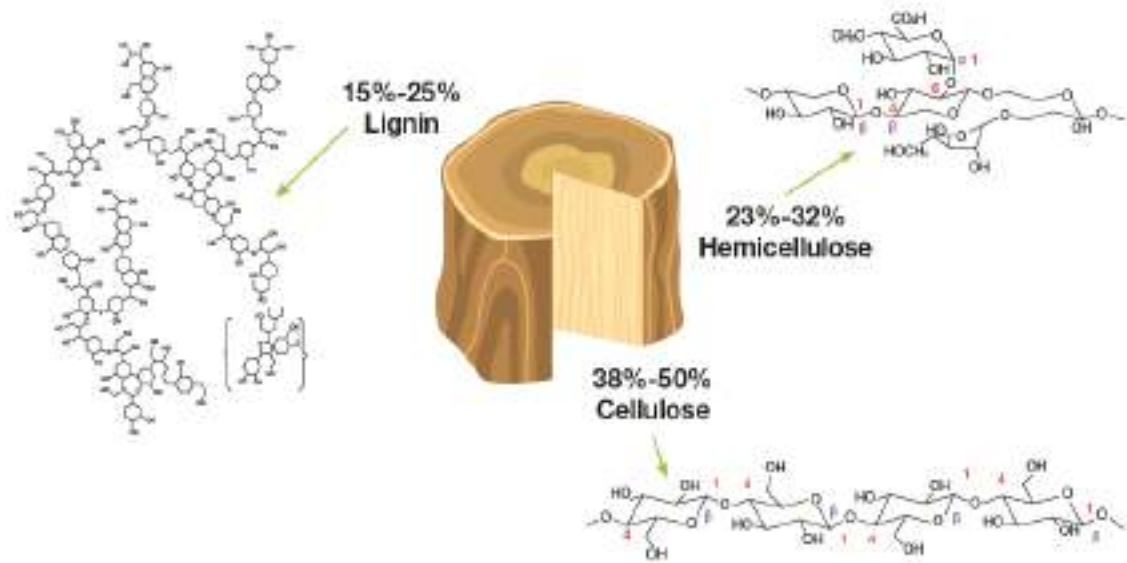
- **Textiles: Rayon & Lyocell**  
Breathable, soft with high moisture absorbency
- **Pharmaceuticals & cosmetics**  
Natural binders for tablets and ethers for cosmetics
- **Food applications**  
Cellophanes for food packaging and maintaining food freshness

sappi | Verve

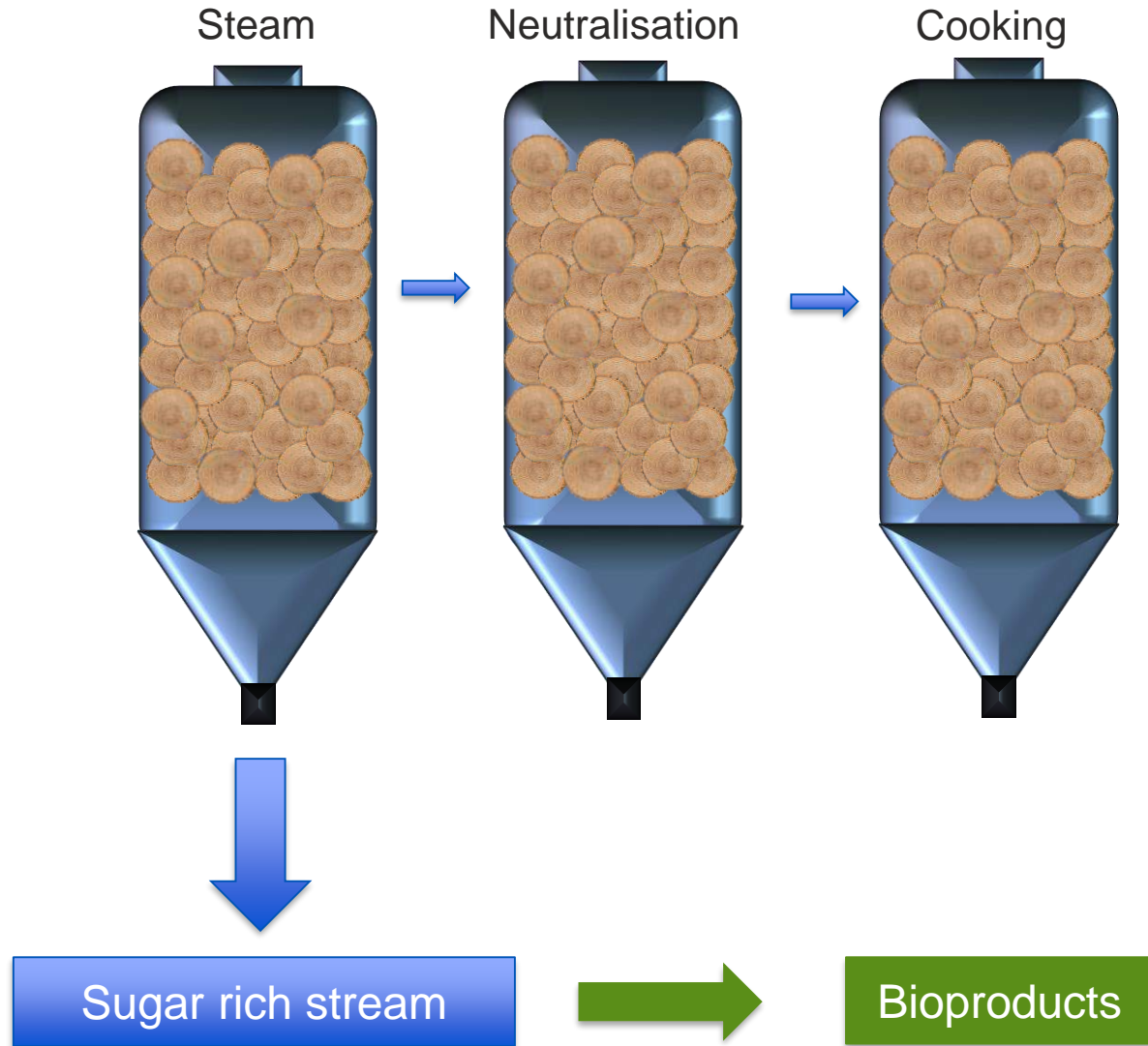




# Hemicellulose sugars



# Pre-hydrolysis kraft process



Cloquet



Ngodwana



# Initial development work at Sappi Technology Centre



- Simulate the process successfully
- Development work - 2012



# The Sugar Demonstration Plant - 2017



- Commissioned in 2017
- > 300 cooks
- >10 000 analyses
- No fouling in reactor
- Similar production time
- Pulp quality – no red flags



# Demonstration evaporation plant - 2019



# Xylose to high value products

Sugars extraction

Evapo-ration

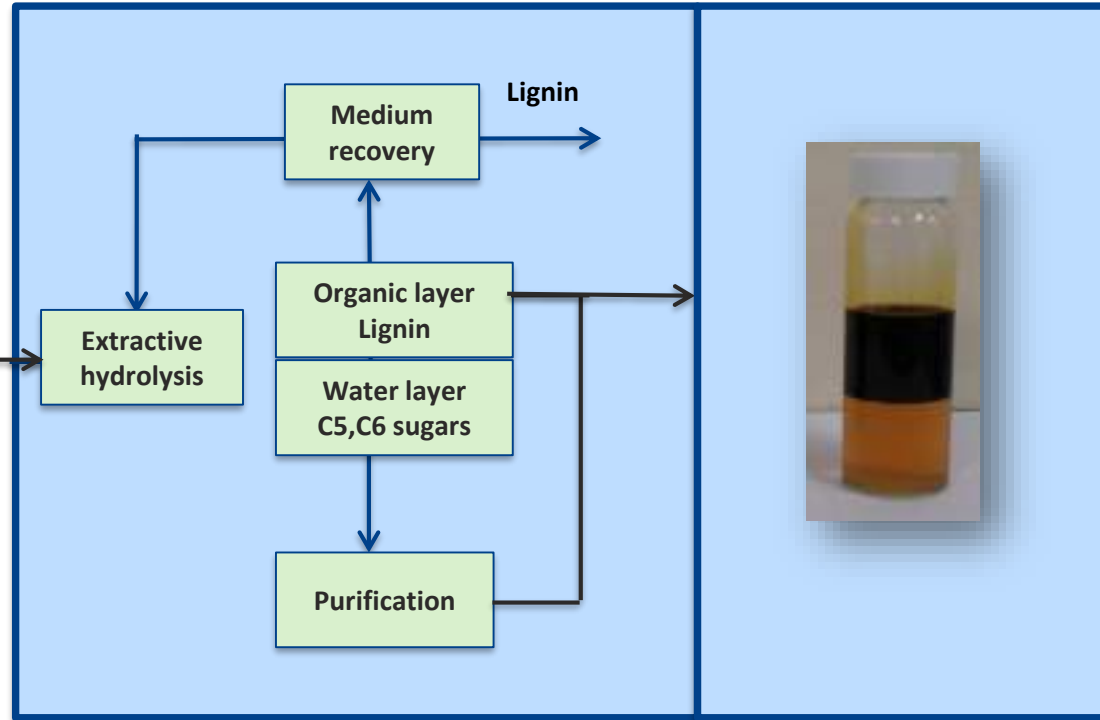
Sugar cleanup

Xylose to high value products



plaxica

Xylex®



This section displays two products. The top part shows a beaker with a yellow liquid and a chemical structure of Furfural (O=Cc1ccoc1) with the label 'Furfural'. The bottom part shows a jar of white powder labeled 'Xylitol' next to some cinnamon sticks.

# High value lignin applications

## Phenolic resins from Sodium Lignosulfonate

- Phenolic resins are made from phenol and formaldehyde, both dangerous and oil based chemicals
- Large focus on finding greener and sustainable feed material
- Functionalised lignin can be this green and sustainable feed





# High value lignin applications

## Polyurethane foams from Sodium Lignosulfonate

- Foams are made from polyols and blowing agents
- Polyols are expensive and oils based
- Lignin can be modified into a polyol substitute from a greener and more sustainable source





# Sustainable Fertilizers

EU Project SusFert:

Sustainable multifunctional fertiliser –  
combining bio-coatings, probiotics &  
struvite for phosphorus and iron supply

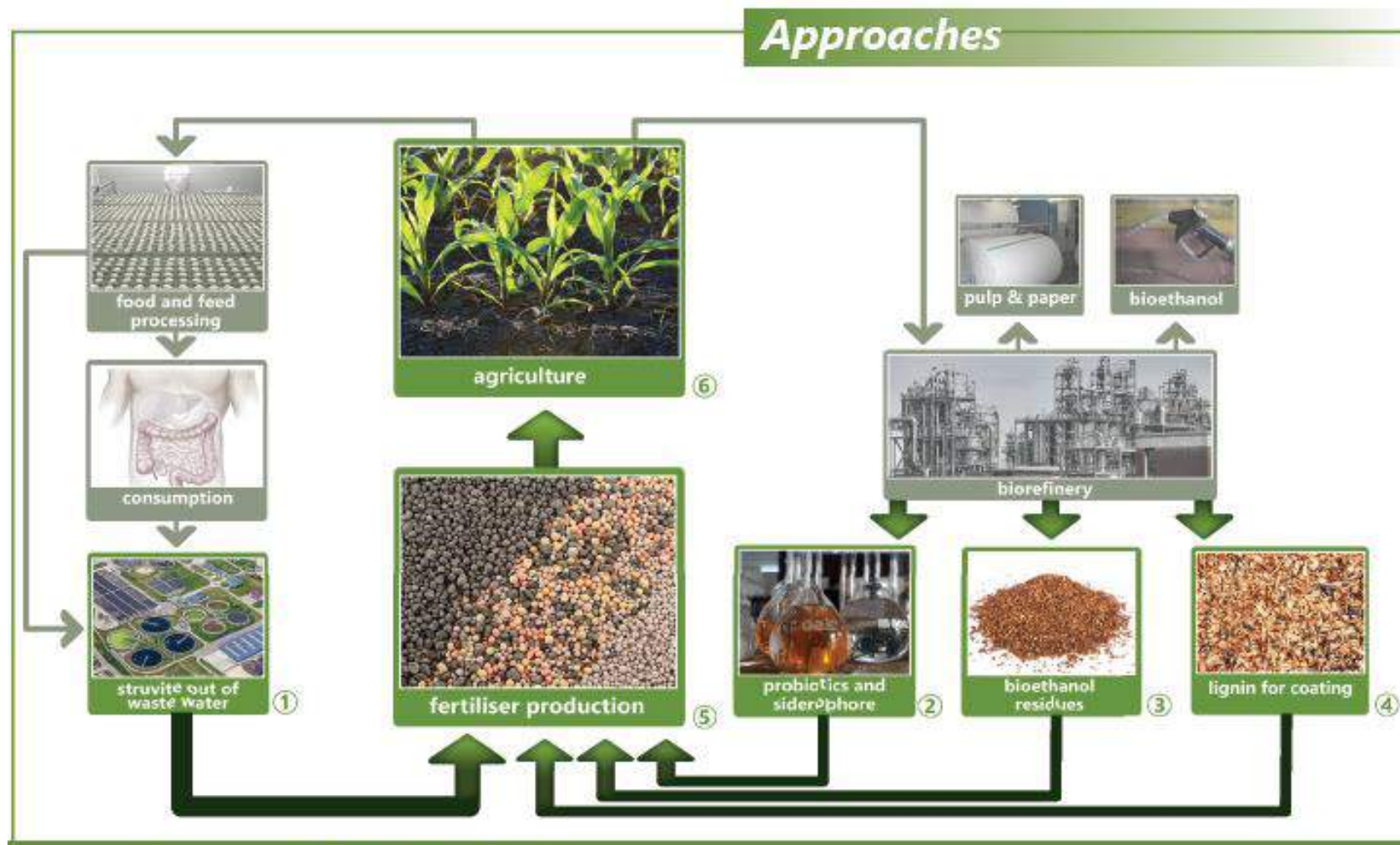
Consortium: 11 partners

<https://www.susfert.eu/>



# Sustainable Fertilizers

SusFert



# Thank you for your attention

---

Nikolaus Schwaiger

Chemical Engineer Biorefinery

R&D Sappi Europe

[Nikolaus.schwaiger@sappi.com](mailto:Nikolaus.schwaiger@sappi.com)

The Sappi logo consists of the word "sappi" in a bold, lowercase, blue sans-serif font.

