

# Retrofit of the AustroCel Pulp & Paper plant



**BIOFIT 7<sup>th</sup> Project Meeting**  
20.10.2021

Dr. Tobias Keplinger, Head of Research and Innovation

# Introduction

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# Location of AC pulp mill



# View on the pulp mill

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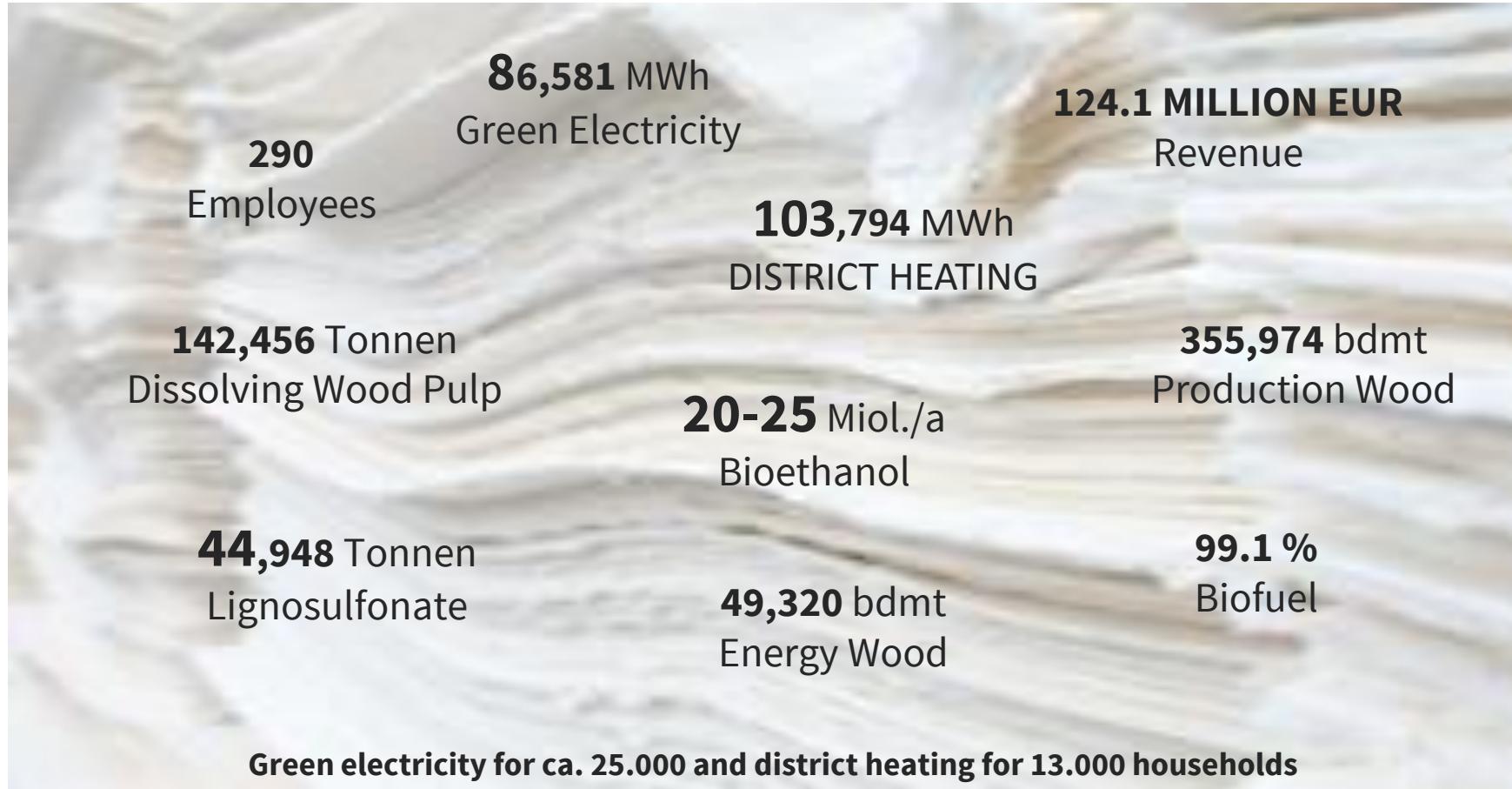


# History

1890	<b>Foundation</b> of the Pulp Mill : <b>The Kellner-Partington Paper Pulp Co. Ltd.</b>
1917 – 1979	Norwegian Era in possession of <b>BORREGAARD</b>
1979 – 1995	Hallein Papier AG in possession of German <b>PWA</b> and the Austrian State Bank
1995 – 1999	Takeover of PWA by Swedish SCA and incorporation into <b>SCA FINE PAPER</b>
1999 – 2000	New foundation of <b>MODO PAPER AB</b> with the Fine Paper Divisions of SCA and MoDo
2000	Purchase of MODO Paper AB by the Finnish Group <b>METSÄ-SERLA</b>
2001	Name change to M-real Corporation and <b>M-real Hallein AG</b>
2006	Launch of a <b>Biomass Combined Heat and Power Plant</b>
2009	<b>Stop of Paper Production</b>
2011	Sale to the Schweighofer Group and renamed to <b>Schweighofer Fiber GmbH</b>
2013	<b>Transition</b> from the production of paper pulp to <b>Viscose Pulp</b> (60 Million Euros investment)
2014 – 2016	12 million Euros of investments in <b>bioenergy</b> from bleaching filtrates ( <b>Winner of the Austrian Energy Globe</b> )
2017	Takeover by TowerBrook and renamed to <b>AustroCel Hallein GmbH</b>

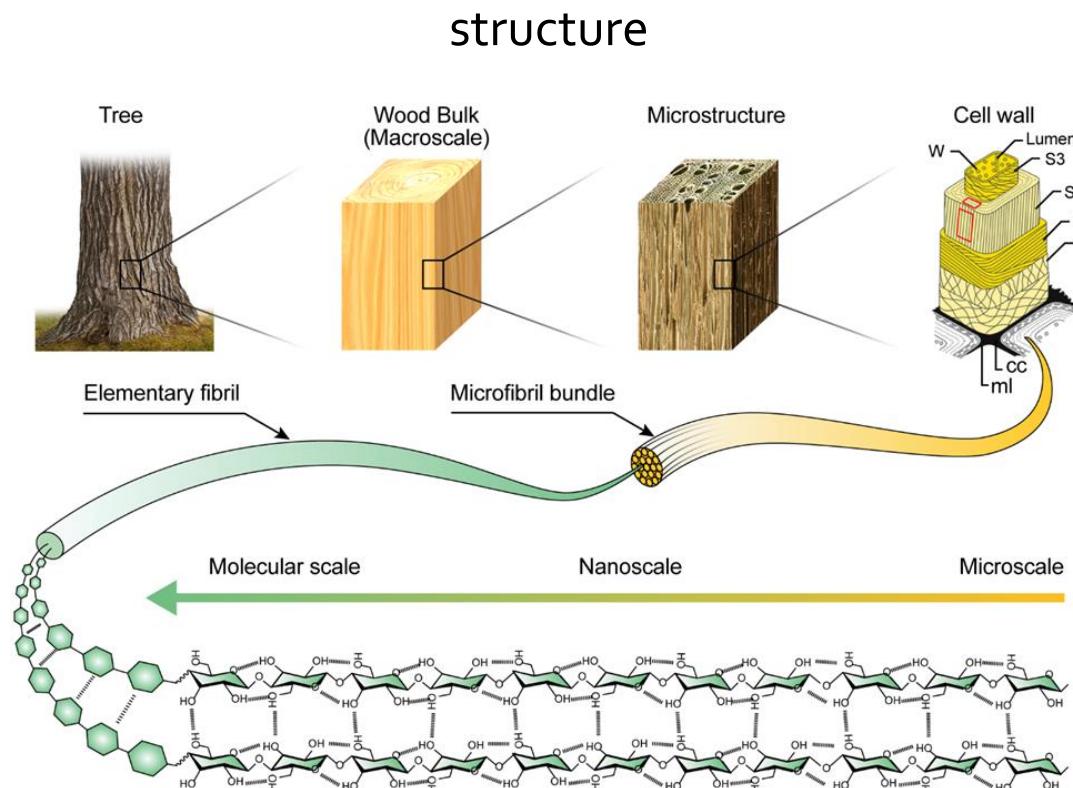


# Key Facts



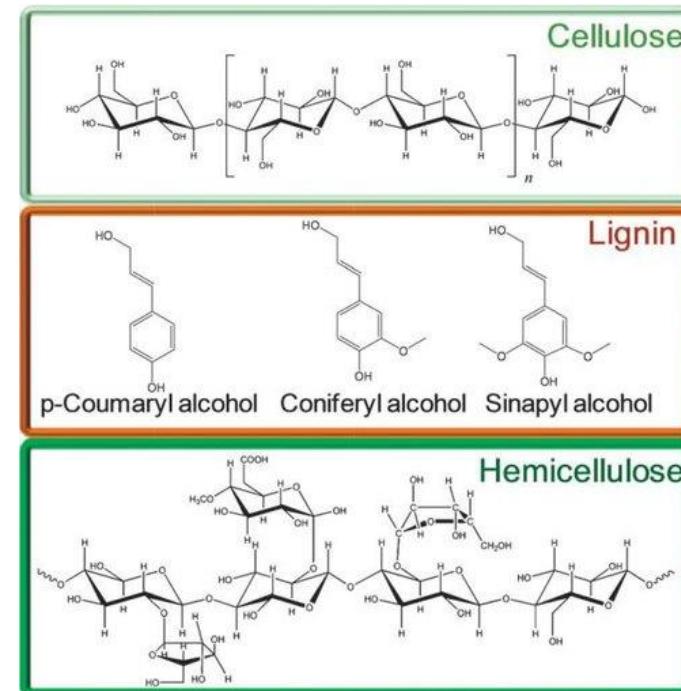
# Fascination Wood

Wood – a fascinating hierarchical material from the macro – to the nanolevel



Chen, Kuang, Hu, Keplinger, Burgert, Zhu, Li, Eichhorn, Berglund; Nature Review Materials, 2020

Composition



40%

30%

30%

Wood a construction material in the past...

Pagoda in the Horyu-Ji Temple - Japan



<https://gizmodo.com/how-japans-oldest-wooden-building-survives-giant-earthq-5846501>

- built 607 AD
- 46X earthquake >7
  
- decoupled floors
- absorbing central pillar «shinbashira»

# Fascination Wood

Wood a construction material in the past...the present and future!

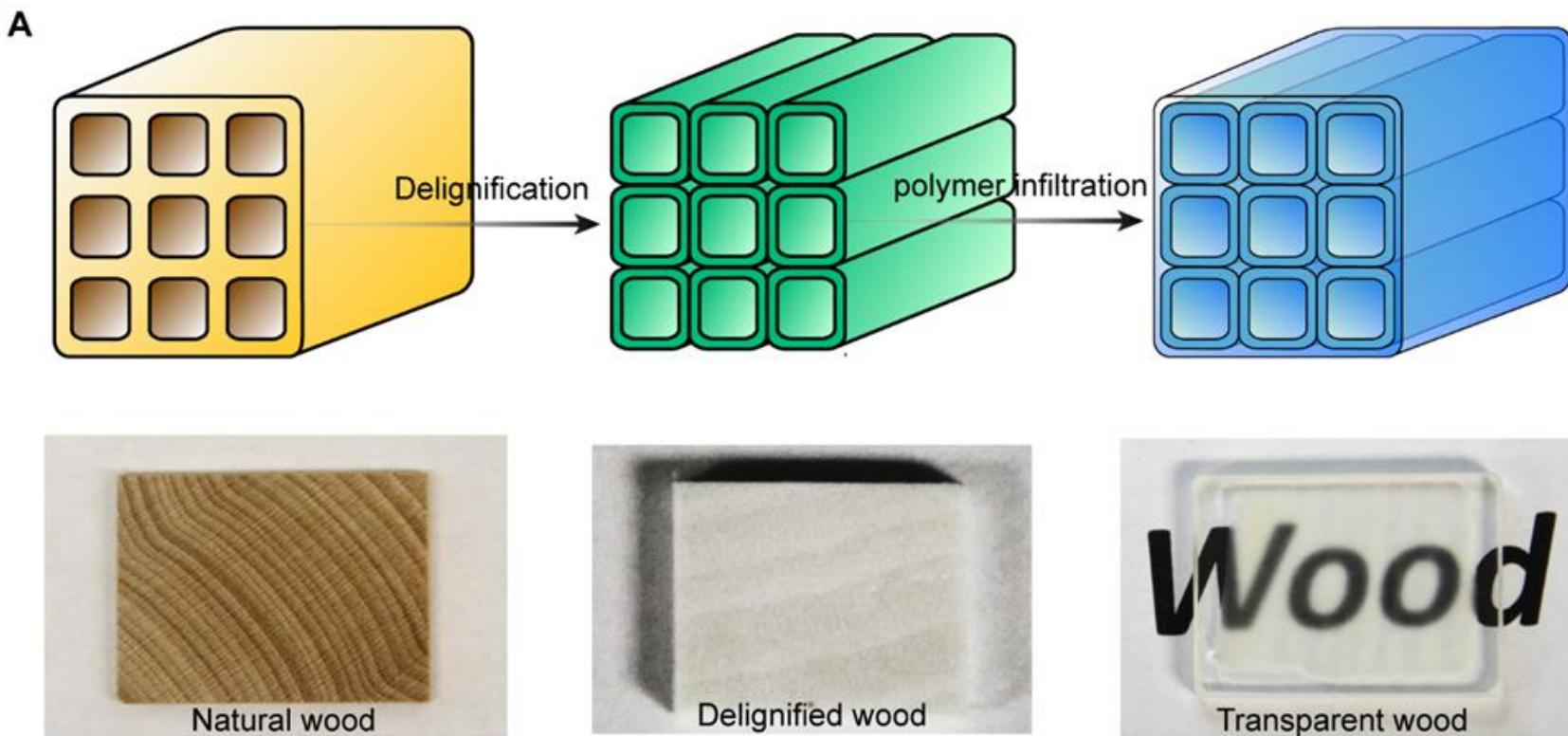
Cambridge mosque project



<https://archpaper.com/2018/09/cambridge-mosque-britain/#gallery-o-slide-o>

- 30 free standing wooden pillars
- 20 00 sqm wooden roof
- digital fabrication
- 5-axes CNC-milling
- mounted within one month

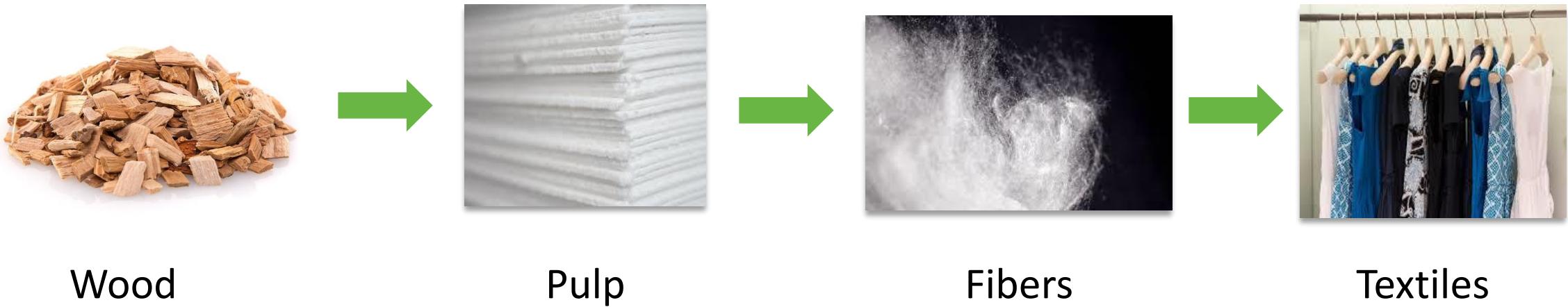
## Transparent Wood



Chen, Kuang, Hu, Keplinger, Burgert, Zhu, Li, Eichhorn, Berglund; Nature Review Materials, 2020

# Fascination Wood

## Textiles out of Wood



# AC-Introduction Movie

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[www.austrocel.com](http://www.austrocel.com)



# Dissolving Wood Pulp Production

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# Dissolving Wood Pulp Production



- spruce wood is composed of:
  - **cellulose 44%**
  - hemicelluloses 28%
  - lignin 28%
- DWP production consists of the following steps
  - production of cooking liquor
  - cooking
  - Washing and sorting
  - bleaching
  - sorting and drying
- the overall yield of DWP related to the utilized wood amount is around **40%**

# Dissolving Wood Pulp Production

## Wood Origin – Green Austria



**47.6 %**

Anteil der Waldfläche

**30.4 Millionen**

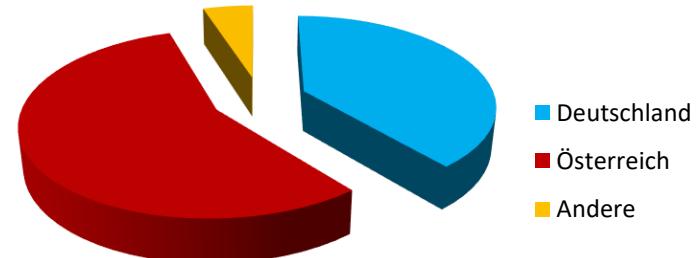
Kubikmeter Zuwachs p.a.

**25.9 Millionen**

Kubikmeter Ernte p.a.

## Wood Origin – @AustroCel

Holzbedarf für Zellstoffproduktion  
900.000 Festmeter jährlich



- PEFC Standard
- Sustainable Forestry
- 110.000 m<sup>3</sup> ring pile



# Dissolving Wood Pulp Production

## Cooking Process



Magnesium oxide



spruce



Sulfur dioxide

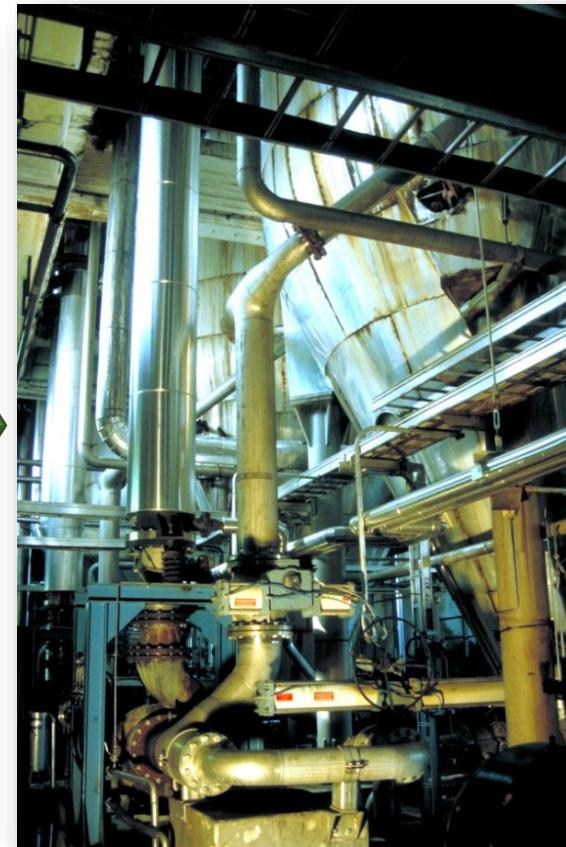


water

Magnesium  
Bisulfite  
Batch process



Temperature: 147 °C  
pressure: 8 bar  
pH-value: 2  
Duration: 8 h



7 digester with 225 m<sup>3</sup> capacity each

# Dissolving Wood Pulp Production

## Bleaching and Washing

### Bleaching Stages

- Sodium Hydroxide (NaOH)
- Oxygen (O<sub>2</sub>)
- Hydrogen Peroxide (H<sub>2</sub>O<sub>2</sub>)
- Ozone (O<sub>3</sub>)

→ TCF Totally Chlorine Free



# Dissolving Wood Pulp Production

## Drying

### Drying Machine



### Final Product



Machine:  
Year of construction:  
Length of the plant:  
Speed:  
Capacity:

Paper machine Beloit  
1964 / 2002 / 2012  
150 m  
100 m/min. (6 km/h)  
420 t/d

### Sheets

### Tambour

# Dissolving Wood Pulp

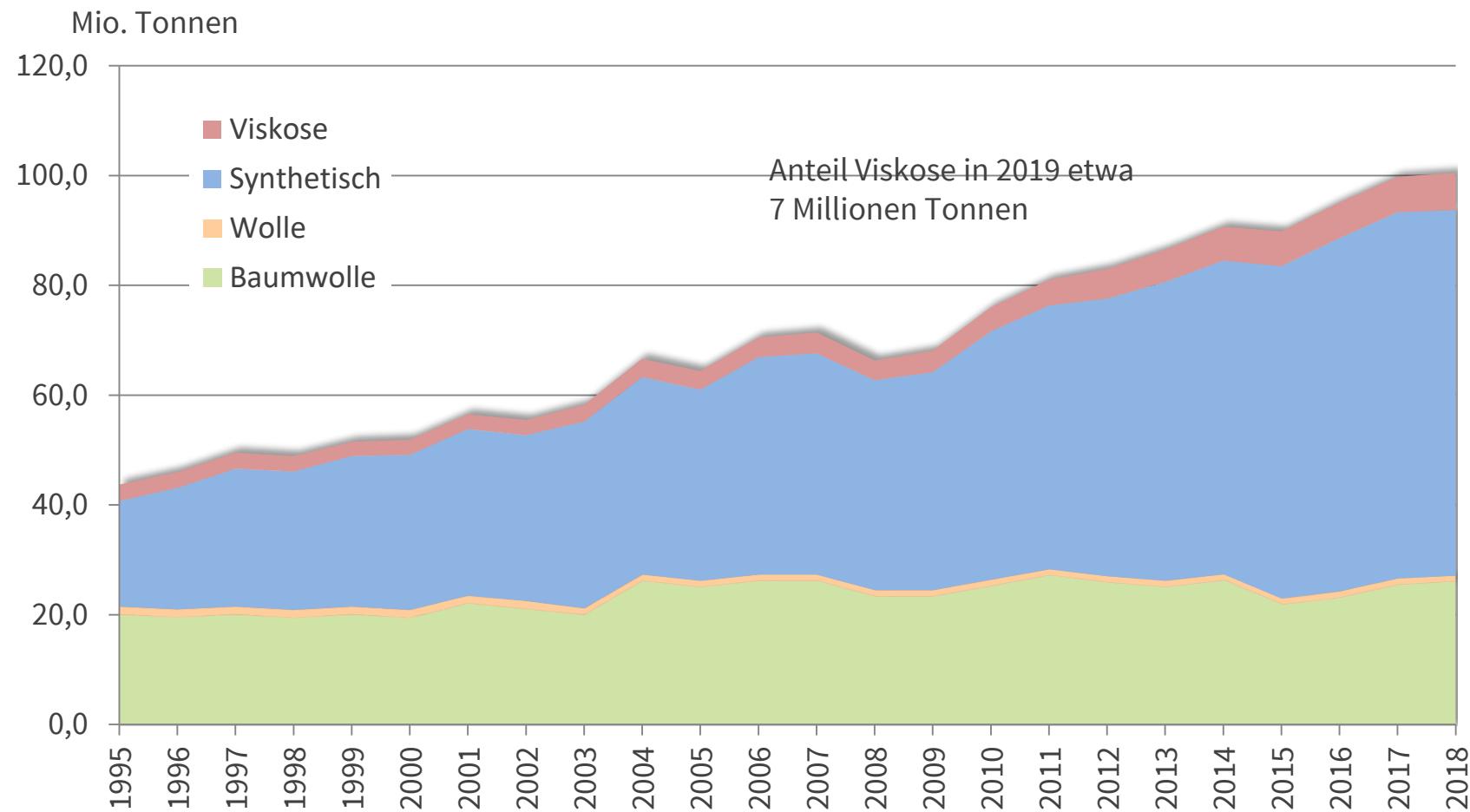
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# From Wood to Textiles

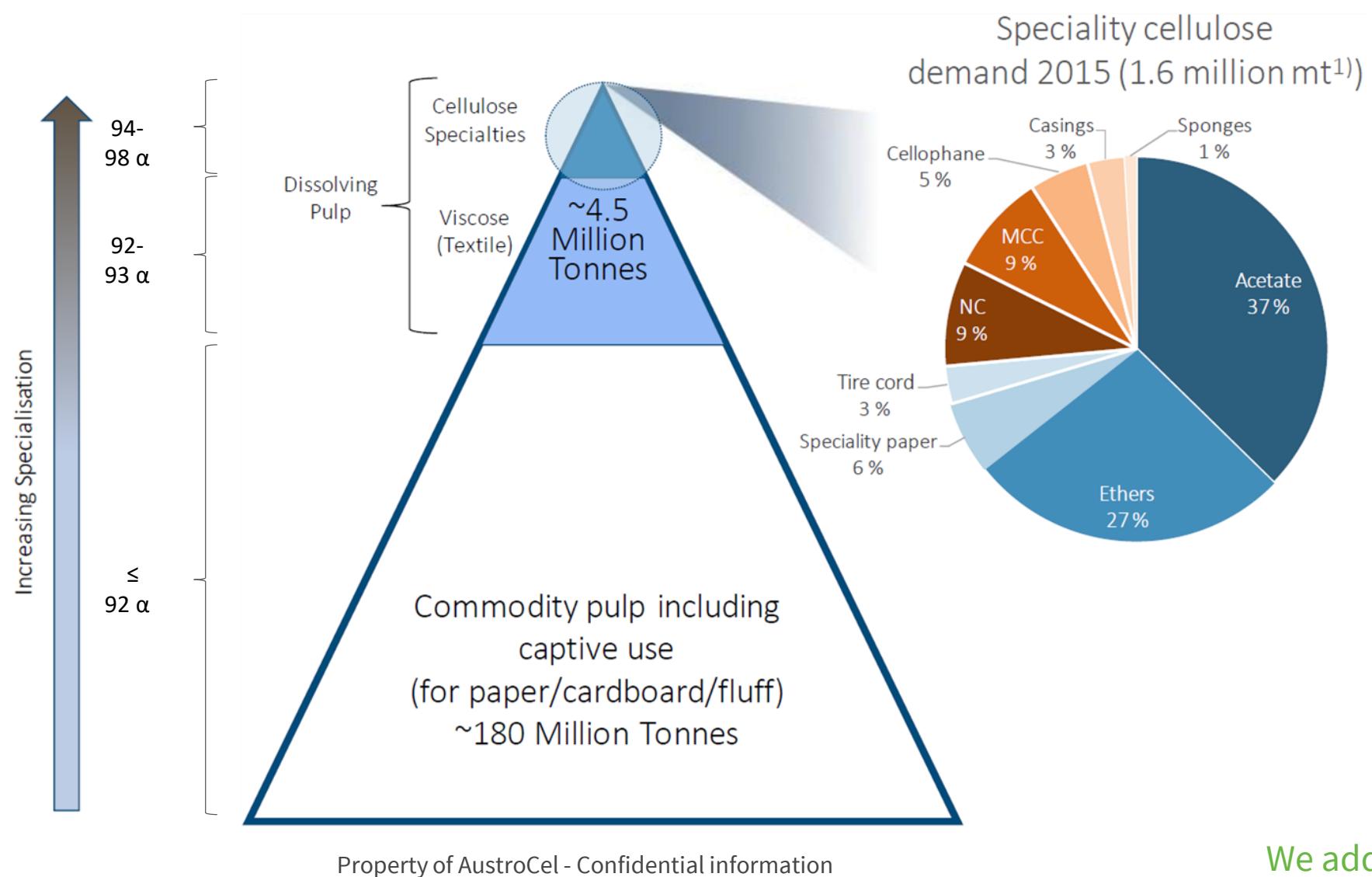
**OC austrocel**  
hallein



# Textile Fiber Market



# DWP Market



# Green Energy

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# Utilization of Side Streams



Wood chips

After cooking

Before bleaching

After bleaching



Filtrates/Rejects

Filtrates

Brown liquor  
(Lignin + sugars)



- spruce wood is composed of:
  - cellulose 44%
  - hemicelluloses 28%
  - lignin 28%

# Energy fr. Bleaching Filtrates + Biomass CHP

## Filtrates

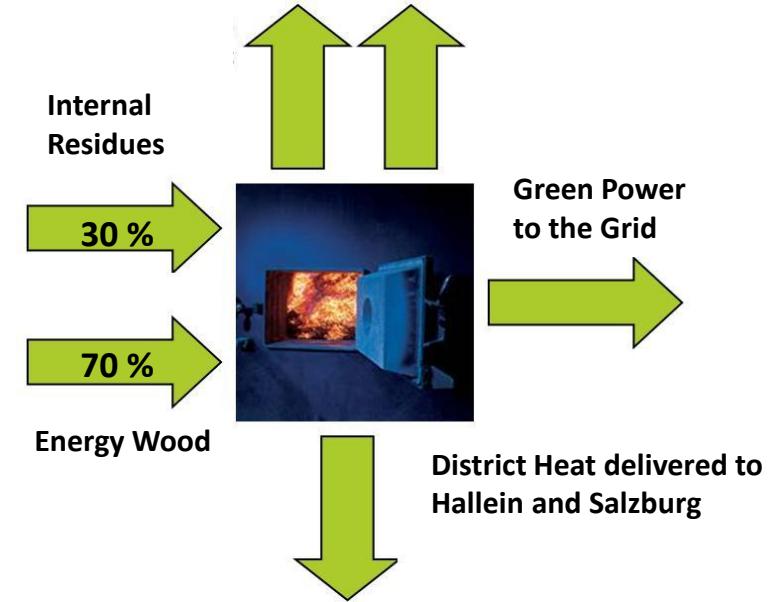


- Biogas production
- capacity around 2.000 m<sup>3</sup>/h.



- 5,125 horse power bio gas motor

## Process Heat Drying Machine



- Year of construction: 2006
- Capacity: 33 MW thermal
- Green energy: 60 GWh p.a.
- District heating: 100 GWh p.a.
- Fuel requirement: 15 t/h
- Internal combustibles: sludge, bark, wood dust, rejects
- External combustibles: forest wood chips, forest wood logs
- CO<sub>2</sub> reduction: 45,000 tonnes p.a.

# Bioethanol (2G)

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# Bioethanol



Wood chips

After cooking

Before bleaching

After bleaching

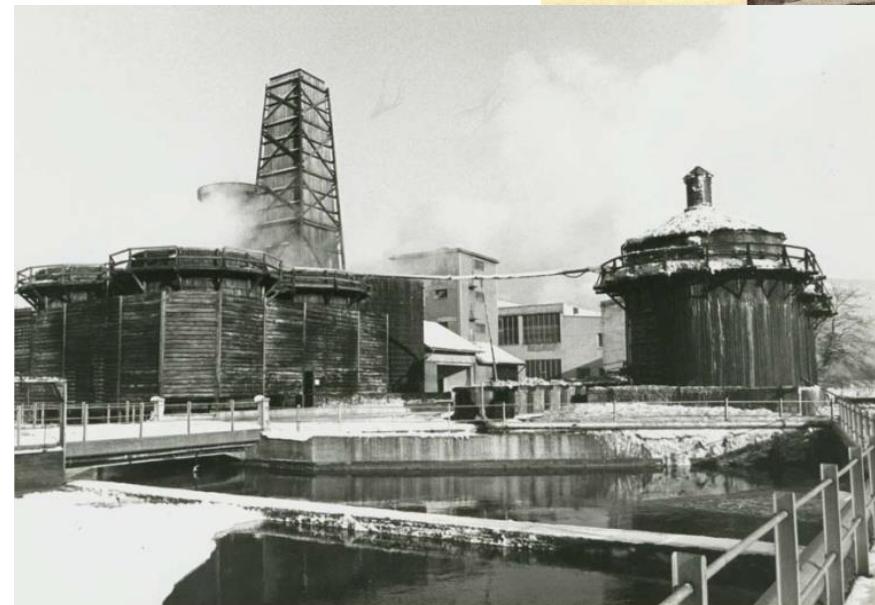


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# History

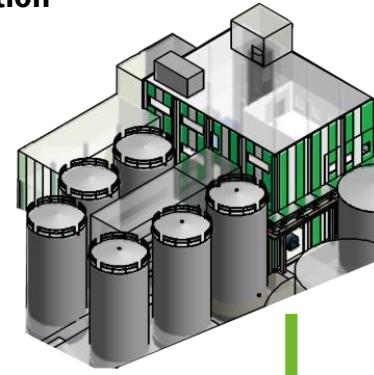
## Timeline

- 1941-1988: bioethanol production from brown liquor (6000 l/day)
- Long-Standing process experience with brown liquor and biotechnology
- **Calculable technological risks**
- 2007 – 2009: technical Pre-Project and Feasibility Study
- **Economic feasibility - Termination of paper production hindered product realisation**
- 2011: conversion to dissolving wood pulp
- **Higher ethanol yields due to increased liquor amount and sugar content**



# Integration and Process

## Fermentation



Pre-concentrated brown liquor

Fermented slurry,

Integrated bioethanol production

Brown liquor from pulp production

Fresh cooking liquor

Prior situation

Concentrated brown liquor

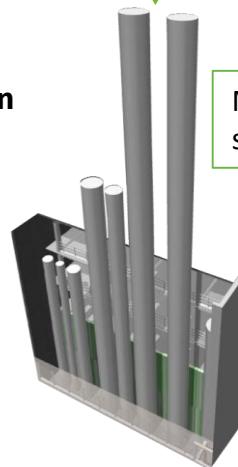


Recovery of chemicals

Energy

Selling of concentrated brown liquor

## Distillation

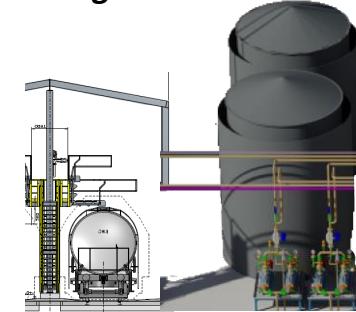


Mash, ethanol free, sugar reduced

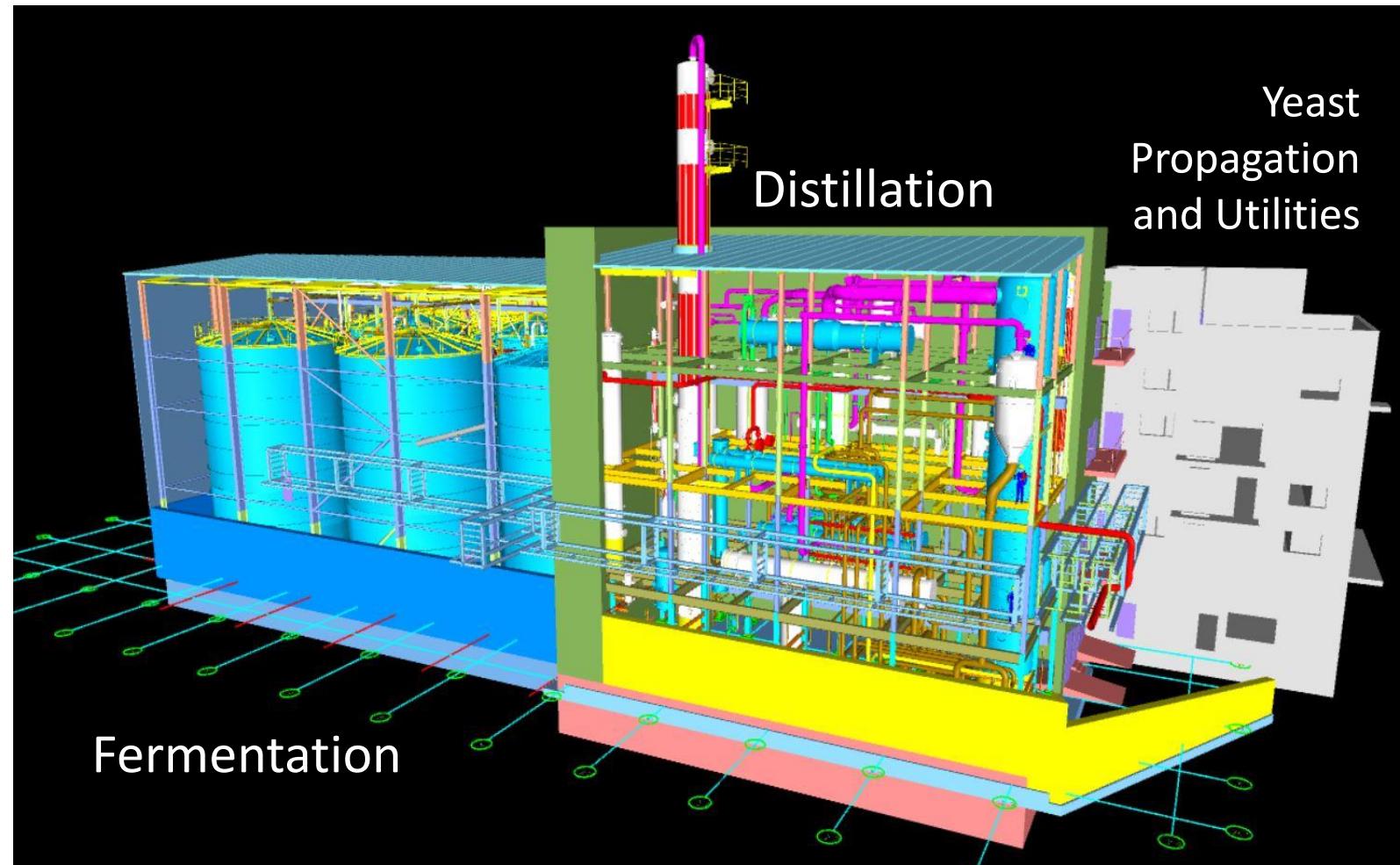
Evaporation plant

ethanol 99,9 %  
Ca. 20.000.000 litre/a

## Filling station



# Bioethanol-Layout



# Bioethanol Production site

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# Time Lapse Video

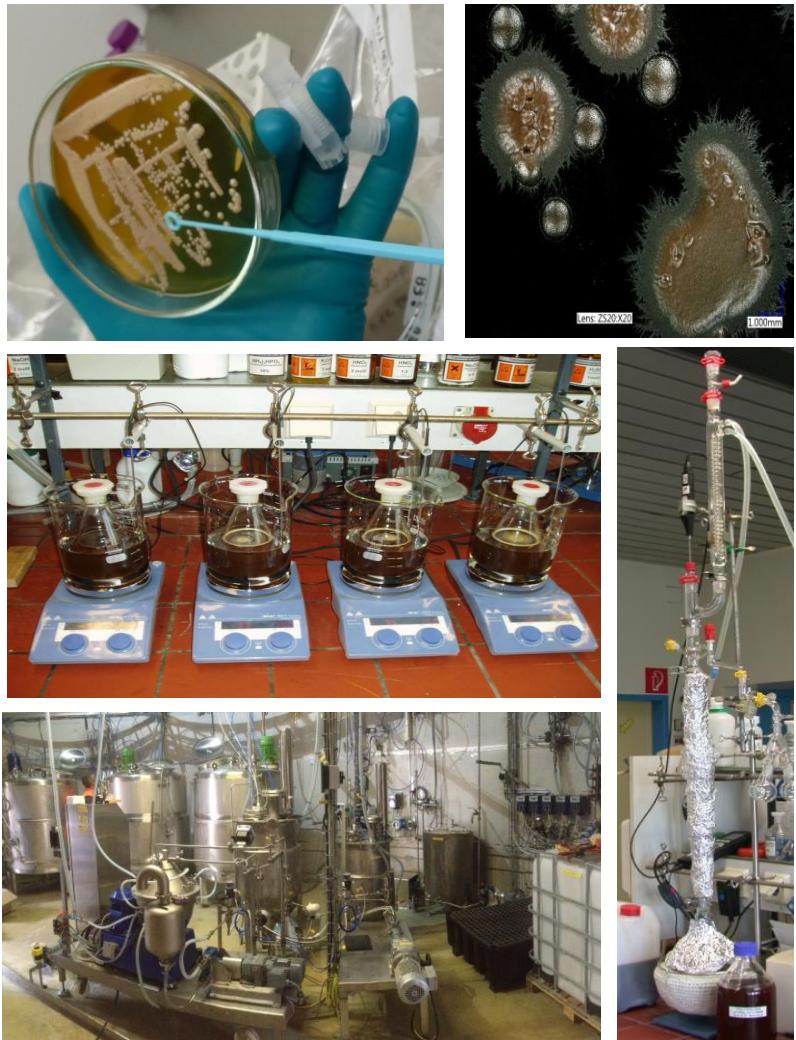
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Can be provided upon request

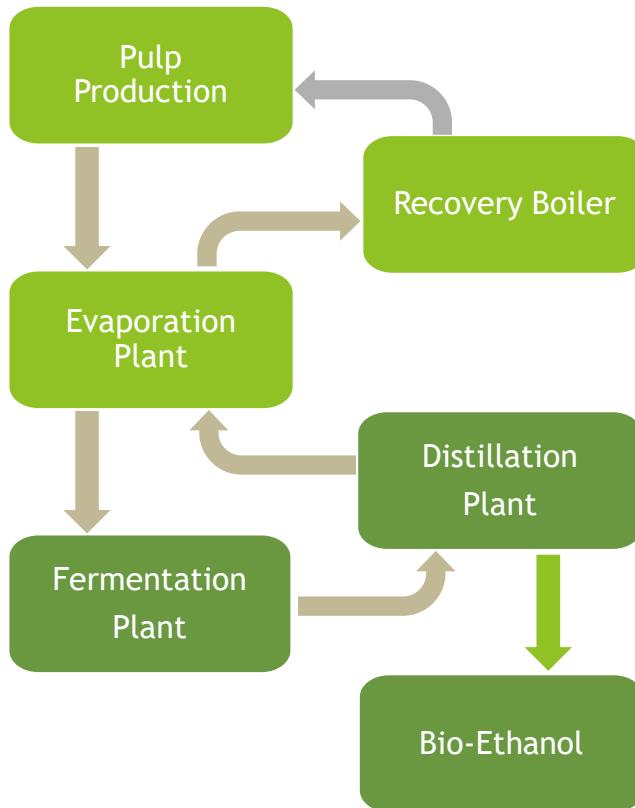
# Research and Innovation

- In-house fermentation and distillations trials+analytics
- In-house Biotechnology expertise
- Continuous Analysis and Control of process parameters and their influence on ethanol yield
- Pilot unit to validate laboratory results and for optimization
- Cooperation and collaboration with universities and external research
- Integrated energy concept



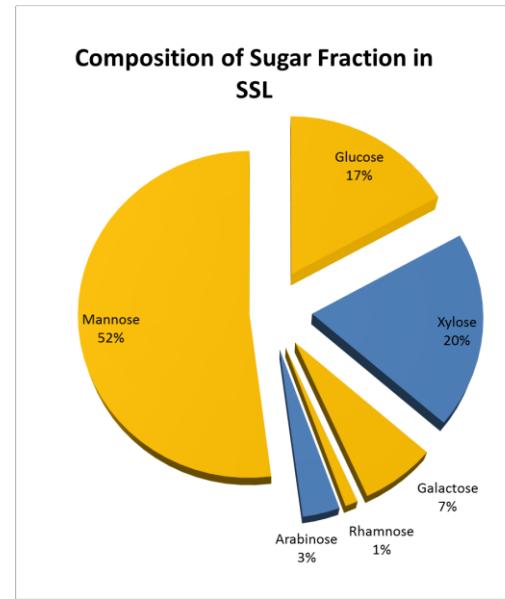
# Summary

## Integrated into Brown Liquor Cycle



**42,000** thousand euros

bio fuel from brown liquor  
up to 35 Million Litres p.a.



- Long-term agreement with OMW secured investment

**1% of Austria's Gasoline Demand**



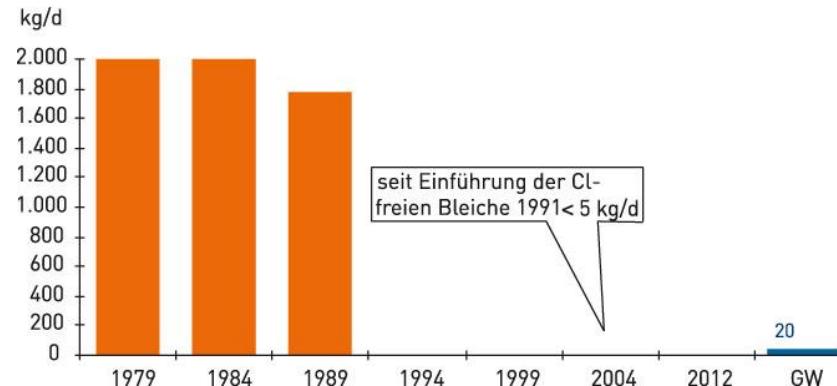
## Legal Basis

### EU- Directive 2018/2001

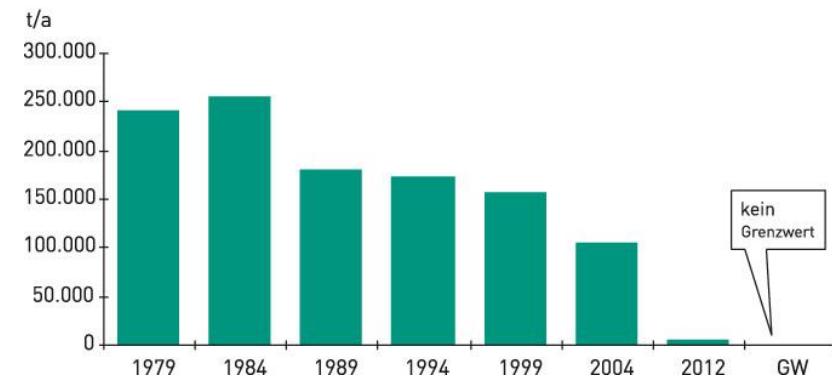
- Obligation of EU to substitute Fossile Transportation Fuels by Advanced Bio-Fuels
- From 2022: 0,2%, 2025: 1%, 2030: 3,5 % of the fossile transportation Fuel in Europe need to be replaced by Advanced Bio-Fuels

# Environmental Key Facts

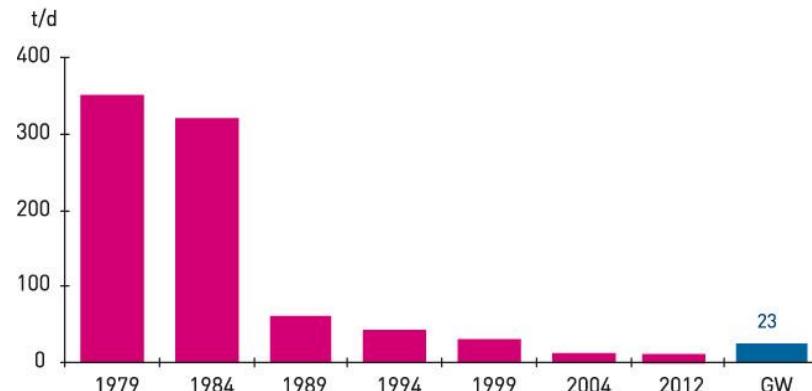
**AOX (kg/d)**



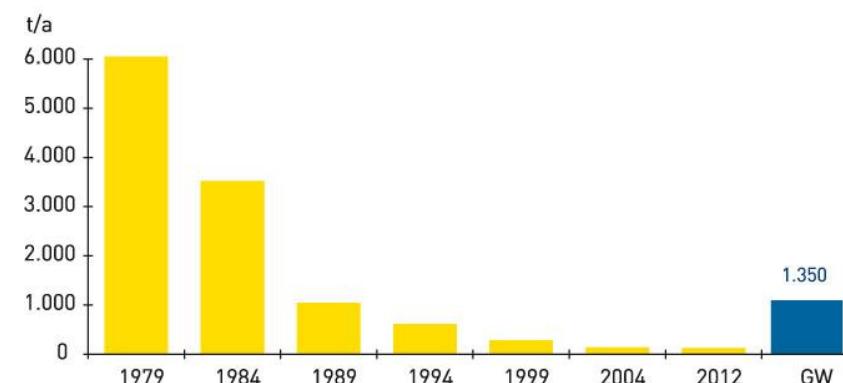
**CO<sub>2</sub> fossil (t/a)**



**CSB (t/d)**



**SO<sub>2</sub> Summe Werk (t/a)**



# AustroCel fighting the climate change



## Don't talk, just do it !