PULP MILLS AND THEIR NEW WOOD BASED BIOPRODUCTS LEAD WAY TO BIOECONOMY

HOLZ IN DER BIOÖKONOMIE

24.10.2019
CHAPTER OVERVIEW

01 ANDRITZ GROUP

02 MARKETS AND MEGATRENDS

03 PULP MILL AND BIOECONOMY

04 NEW BIOPRODUCTS
ANDRITZ is a globally leading supplier of plants, equipment, systems and services for hydropower stations, the pulp and paper industry, the metalworking and steel industries, and solid/liquid separation in the municipal and industrial sectors as well as for animal feed and biomass pelleting

**Global presence**
Headquarters in Graz, Austria; over 280 production sites and service/sales companies worldwide

### KEY FINANCIAL FIGURES:

<table>
<thead>
<tr>
<th></th>
<th>UNIT</th>
<th>H1 2019</th>
<th>2018</th>
</tr>
</thead>
<tbody>
<tr>
<td>Order intake</td>
<td>MEUR</td>
<td>3,705.2</td>
<td>6,646.2</td>
</tr>
<tr>
<td>Order backlog (as of end of period)</td>
<td>MEUR</td>
<td>7,724.2</td>
<td>7,084.3</td>
</tr>
<tr>
<td>Sales</td>
<td>MEUR</td>
<td>3,062.4</td>
<td>6,031.5</td>
</tr>
<tr>
<td>Net income (including non-controlling interests)</td>
<td>MEUR</td>
<td>75.8</td>
<td>219.7</td>
</tr>
<tr>
<td>Employees (as of end of period; without apprentices)</td>
<td>-</td>
<td>29,616</td>
<td>29,096</td>
</tr>
</tbody>
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**SALES BY REGION 2018 (%)**

- **Europe & North America**: 59%
- **Emerging markets**: 41%

6,031 MEUR
A WORLD MARKET LEADER WITH FOUR BUSINESS AREAS

PULP & PAPER

PRODUCT OFFERING
Equipment for production of all types of pulp, paper, tissue, and board; energy boilers

METALS

PRODUCT OFFERING
Presses/press lines for metal forming (Schuler); systems for production of stainless steel, carbon steel, and non-ferrous metal strip; industrial furnace plants

HYDRO

PRODUCT OFFERING
Electromechanical equipment for hydropower plants (turbines, generators); pumps; turbo generators

SEPARATION

PRODUCT OFFERING
Equipment for solid/liquid separation for municipalities and various industries; equipment for production of animal feed and biomass pellets

* Share of total Group order intake 2018
MEGATRENDS

Long-term changes that have a clear direction

- **Environmental awareness**
  - Climate change
  - Waste, pollution
  - Resource scarcity
- **Economic, political**
  - Shift in global (economic) power
  - Intensified global competition
- **Technological**
  - Digitalization
- **Social**
  - Population growth
  - Growing middle class
  - Urbanization
  - Changing consumer habits

FROM FOSSILE TO BIOECONOMY
WORLD DEMAND FOR PAPER & PAPERBOARD BY GRADE 2017-2030

Source: Pöyry, World Paper Markets up to 2030 (2017 Ed)
Dissolving pulp consumption

Fast growth in dissolving pulp demand due to textile fibre demand

Source: Pöyry
FIBER DEMAND FOR TEXTILE AND NONWOVEN APPLICATIONS

“Cellulose gap”

Source Lenzing
PULP MILLS AS A MEANS TO ENHANCE BIOECOMY

Pulp Mill Process

- Wood handling
- Chemical Plant
- Drying and Finishing
- Fiberline
- Chemical Recovery
- Water and Effluent Treatment
- Power Plant
Increasing value of bioproducts from pulp mill side streams

- **Traditional bioproducts, increased efficiency. Potential only partly utilized**
- **New potential**
- **Future potential**

- Excess energy:
  - Electricity
  - Heat
  - Hog fuel

- Tall oil (SW)
- Turpentine (SW)
- Biomethanol
- Lignin
- Sulphuric Acid
- Biogas from bark & sludge
- Fertilizers from dregs
- Fertilizers from ash
- Other Bioproducts, Chemicals e.g. MCC

**Side streams**

- **Chemical pulp mill**
- **Market pulp**
NEW BIOPRODUCTS AND PROCESSES

Response from Fossil Economy change towards BioEconomy

INCREASED FIBER DEMAND
CHEMICAL PULP USE OUTSIDE OF PAPERMAKING HAS LARGE PULP DEMAND UPSIDE POTENTIAL

Traditional pulp demand forecasts are based on paper demand projections…
SUSTAINABLE PULP PRODUCTION AT METSÄ FIBRE ÄÄNEKOSKI

Bioproducts concept: all side streams 100% utilized

* Current bioproducts

New biofuels from bark and energy wood

Producer gas from bark and sludge for the mill’s own use

Sulfuric acid and methanol from odorous gases for the mill’s own use

New bioproducts from lignin

Biogas from sludge for traffic fuel

Fertilizers and earth work material from dregs and ashes

New textile fibers from pulp

Biocomposites from pulp

Source: Metsä Fibre
ANDRITZ  AaltoCell™
Micro Crystalline Cellulose plant

• Microcrystalline cellulose (MCC) is purified, partially depolymerized cellulose
• Global annual MCC production around 180,000 tons, growing from 5% to 15% / year depending on the produced grade
• Applications in pharmaceuticals, food, paints, industrial solutions and cosmetics. Recognized potential as animal feed additive.
• Estimated market value 940 M USD/a (2019).
• Price variation between 2,000–10,000 €/ton.
• A unique pulp mill integration capability into an existing pulp mill
• Hydrolysates can be refined to other bio products
• Lower global warming potential than traditional commercial MCC production

KEY SUCCESS FACTOR
Cost effective AaltoCell™ process method and low GWP
### MCC APPLICATION AREAS

MCC now and in the future – segments and potential

#### PHARMACEUTICALS
- Binding agent, disintegrant, filler, diluent, viscosity adding agent, coatings
- Suitable for various processing technologies
- Tablets, capsules, pills

#### FOOD AND BEVERAGES
- Texturizer, anti-caking agent, emulsifier, bulking agent
- Stabilizer: heat, emulsion, sedimentation
- Viscosity modifier
- Improving flavor
- Dietary fiber
- Reducing: fat uptake, calorie uptake

#### PERSONAL CARE COSMETICS
- Suspending aid, thickener, stabilizer, volume effect
- Absorption effect, silkening feeling
- Substitution for polyethylene beads (or other micro plastics)
- Transparency increase
- Opacifier

#### ANIMAL FEED
- Poultry feed, proven results in FCR
- Swine feed
- Aqua feed
- Pet slimming agent

#### TEXTILES
- Smart textiles with improved properties
- Replacement in fossil based textiles
- Cotton replacement/viscose replacement

#### INDUSTRIAL
- Absorbent in paints
- Rheology modifier in paints and coatings
- Water treatment flocculant

#### COMPOSITES AND PLASTICS
- Substitute for other feedstock and properties improvement
- Reinforcement agent
- Composites

#### OTHERS WILD CARDS
- Sound dampening
- Absolute white/black
AALTOCELL™ AS SIDE DEPARTMENT OF FIBERLINE
Pulp Mill and AaltoCell™ manufacturing

Wood processing

Pulp mill provides:
- Raw material pulp
- Water
- Steam
- Electricity

MCC

Waste water chemical recovery or re-use in fiberline

Fiberline

Drying and bale finishing

WOOD

PULP
BIOPRODUCTS

A-Recovery +

- Methanol
  - Internal purification of methanol separated in evaporation for further use in ClO₂ plant, lime kiln or sold as merchant methanol
  - Nearly three times higher value than when burnt for electricity generation
- H₂SO₄
  - Commercial quality concentrated H₂SO₄
- Lignin
  - Lignin recovery for debottlenecking of recovery boiler, or for production of merchant lignin

KEY SUCCESS FACTOR
Integrated chemical recovery with 1.5-3 years pay-back time
Fossil fuel free pulp mills with CO₂ neutral lime kiln firing

- Gasification of bark and rejects for lime kiln fuel
  - MetsäFibre Joutseno
  - Chenming Zjanjiang
  - Chenming, Meilun
- Saw dust firing
  - SCA Östrand
- Lignin firing
- Other side streams, MeOH, H2, etc

KEY SUCCESS FACTOR
ANDRITZ Carbona gasification plant
ENERGY EFFICIENCY

Leading to increased power generation

Development of power consumption and generation in pulp mills, Softwood (excluding power boiler and chemical plant)