Biomaterials – Innovating for the future
Markus Mannström
EVP, Biomaterials division
Our road to success in the bioeconomy

Introducing new products and services

Addressing attractive end-use segments

Delivering sustainable profitable growth

Generating superior ROCE
**Biomaterials has the widest offering in the market**

- **60 countries**
- **1,376 MEUR sales 2016**
- **+13.5% Q3 YOY 2017**

**R&D centres**
- 4
- 2 new products since 2014
- 6 strategic partnerships on innovation
- 7 digitalisation projects

**Well managed certified renewable raw material**
- 5 pulp mills
  - Finland, Sweden, Brazil, Uruguay
- 2.15 MT market pulp

**203 MEUR EBIT**
- Q1–Q3/17

**14.8% ROOC**
- Q3/17

**Only 18%** of our external market pulp sales are geared to the **graphic paper market**

**1,700 employees**
- 22% are women
Our three focus areas

Maximize value from eucalyptus pulp

- Continue to improve production efficiency
- Improve cost competitiveness in Montes del Plata

Differentiate our Nordic pulp business

- Reduce exposure in softwood
- Grow in fluff and dissolving pulp
- Continue to improve production efficiency
- Innovate on pulp applications with current customers

Create new platforms for growth

- We build and develop strong business on:
  - Improved pulp properties
  - Regenerated cellulose and MFC
  - Lignin
  - Bio-based chemicals
  - Extraction and separation technologies
Global trends enhance pulp growth…

Textiles, non-wovens
- 100 Mt market, growing 3%/y
- 6.1 Mt market pulp (dissolving)

Hygiene
- 590 billions of converted unit, growing 3.6%/y
- 6 Mt market pulp (fluff)

Paper
- Graphic: 108 Mt market, declining -2.5%/y
- 17 Mt market pulp

Tissue
- 34 Mt market, growing +3.5%/y
- 2 Mt market pulp

Cartonboard
- 4 Mt market, growing 2.5%/y
- 4.5 Mt market pulp

Source: Pöyry Consulting Group, Hawkins Wright, Smithers Pira, RISI, Bradesco

8 November 2017
Stora Enso CMD
...and we have the widest pulp portfolio in the market

Internal consumption 63%

Stora Enso pulp capacity 5 800 Kt
Among the TOP10 largest pulp producers

42% Hardwood 900Kt
37% Softwood 800Kt
12% Fluff 250Kt
7% Dissolving 150Kt
2% UKP 50Kt
We are differentiating our pulp mix…

Maximize value from eucalyptus pulp

Improve competitiveness of our Nordic mills (Fluff and dissolving)

Today
- Softwood: 42%
- Hardwood: 37%
- Fluff/dissolving: 21%

Target 2020
- Softwood: 43%
- Hardwood: 42%
- Fluff/dissolving: 15%
...and pulp demand is growing in our strategic segments

Pulp demand to 2021 in million tonnes (Mt)

Source: Hawkins Wright, Pöyry, Stora Enso

<table>
<thead>
<tr>
<th>Grade</th>
<th>Mt</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hardwood</td>
<td>4.2</td>
</tr>
<tr>
<td>Softwood</td>
<td>0.7</td>
</tr>
<tr>
<td>Fluff</td>
<td>1.1</td>
</tr>
<tr>
<td>Dissolving Pulp</td>
<td>2.4</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>8.4</strong></td>
</tr>
</tbody>
</table>

CAGR: + 2.5% ~ + 1.7 million tonnes (Mt)/year
Balanced market expected

Hardwood and softwood average capacity growth (Mt/year)

- 2006-2016: +1.4 Mt/y (90% ratios)
- 2017-2021: +1.2 Mt/y

Announced capacity growth 2017–2021: 6.2 Mt (1.2 Mt/year)

- Softwood 2.4 Mt
- Hardwood 3.8 Mt

Cash cost by country

Source: Pöyry, Hawkins Wright
Wood price impact in pulp industry

Average industry pulp cost breakdown

<table>
<thead>
<tr>
<th>Region</th>
<th>Hardwood</th>
<th>Softwood</th>
</tr>
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<tbody>
<tr>
<td>Brazil</td>
<td>33</td>
<td>29</td>
</tr>
<tr>
<td>USA</td>
<td>41</td>
<td>35</td>
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<tr>
<td>Chile</td>
<td>51</td>
<td>34</td>
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<tr>
<td>Canada</td>
<td>35</td>
<td>41</td>
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<tr>
<td>Nordics</td>
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<tr>
<td>Portugal</td>
<td>51</td>
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<td>Indonesia</td>
<td>51</td>
<td>n/a</td>
</tr>
<tr>
<td>China</td>
<td>80</td>
<td>74</td>
</tr>
</tbody>
</table>

Source: Hawkins Wright, Pöyry
1 EUR = 1.123 USD

Q2/17 (USD/m3/sob) at mill
New capacity does not fully correlate with pricing

Source: Pöyry (net price included average estimated discounts)
Exchange rate has an impact on pulp pricing

Source: European Central Bank and Pöyry (net price included average estimated discounts)
GDP correlating well with pulp prices

GDP growth *

Source: IMF and Pöyry (net price included average estimated discounts)

* Based on G20 countries, representing more than four-fifths of gross world product
Pulp price is stable compared to other commodities

Source: World Bank, Pöyry (net price included average estimated discounts)
Innovation is key for sustainable profitable growth

Product platforms

1. Improved pulp properties
2. Regenerated cellulose & MFC
3. Lignin
4. Bio-based chemicals

Technology platform for extraction & separation
Platform 1: improving pulp properties for existing products

**Fluff pulp**
- Hygiene and health, growing by 3.6% per year
- Life expectancy and increased disposable income in developing countries
- Improve fluff pulp properties to increase customer value

**Dissolving pulp**
- Dissolving pulp to textiles is a 6.1 Mt market, growing 6.8% per year
- The increase of cellulosic fibre in textiles is driven by global brand owners
- Improve quality to be able to differentiate in the value chain

**Pulp for specialty papers**
- Flexible packaging, labels, security, décor, among others
- 28 Mt market, growing 1.8% per year
- Fibre improvements, special additives, sustainable coatings & barriers, source reduction and other innovation opportunities

Source: Smithers Pira, Hawkins Wright
Platform 2: Developing new technologies for using wood fibre in textiles, non-woven and specialty papers

Regenerated cellulose

- Participate in the development of new technologies for using wood fibre in textile
- Growing interest from global brand owners increases demand for renewable fibres
- Opportunity to leverage on existing assets to enter this new market

MFC

- MFC has potential to be used in specialty papers and non-woven
- MFC is a versatile material with potential to work as strength enhancer, additive, binder and barrier material
- Stora Enso has a long history in the research of MFC and has a demonstration plant in Imatra, Finland

Source: Stora Enso
Platform 3: Lignin – big opportunities in many markets

**Phenol replacement**
- Phenolic resins is a 2.8 Mt market, growing at 4% CAGR
- It replaces phenol in adhesives for plywood, OSB (oriented strand board), laminates, LVL and other wood construction materials
- The carbon footprint for lignin is roughly 1/10 of the carbon footprint of phenol

**Carbon fibre**
- Light-weight high performance composites
- 70–80 Kt market, growing at 9–12% CAGR
- Low-carbon-footprint carbon fibre is unoccupied market space

**Energy storage**
- Substitution of conventional hard carbon anode materials in energy storage, namely Li-Ion Batteries and Supercapacitors
- Market growing on average by 20% CAGR
- Key applications: portable consumer electronics, power tools, electrical vehicles, stationary applications and back-up systems

Source: Stora Enso, Carbon Composites, IDTechEx, LuxResearch, Markets and Research, Zion Research
Platform 4: Bio-based chemicals replacing fossil-based materials

Bioplastics and intermediates

- Growing interest in packaging/bottling markets for renewable solutions
- Reduction on carbon footprint and enhanced properties are key target areas
- Market clearly favoring second generation biomass as the raw material source
- It is a very populated market place, thus, strategic alliances will be crucial to win in this industry

Xylose

- Key application is the xylitol (sweetener) market (approximately 120 Kt at 4–6% CAGR)
- Compared to C6 sugars it still is a rather undeveloped market, mainly due to lack of pure xylose availability. This is changing with the biorefinery concepts
- Growing interest and developments taking place in the market
- Stora Enso well positioned to be a frontrunner here

Source: PwC, Kline and Industry experts
Strategic steps for new business and differentiation

**Pulp business - New platforms for growth**

- **2012**
  - Enocell dissolving pulp
  - Montes del Plata hardwood
  - Virdia acquisition

- **2014**
  - Sunila lignin
  - Innovation centre for biomaterials

- **2015**
  - Partnership with Rennovia

- **2016**
  - B2X demo plant, Raceland USA

- **2017**
  - Skutskär increased fluff

- **2018**
  - Enocell dissolving pulp II

- **2019**
  - Future growth options
    - Grow in fluff and dissolving
    - New business from R&D platforms
    - Improve efficiency and increase output in existing operations
Our three focus areas

Maximize value from eucalyptus pulp

Differentiate our Nordic pulp business

Create new platform for growth

Delivering sustainable profitable growth
1% shift of fossil-based and other materials = 20 BEUR renewable business
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