Reinventing the Forest Products Industry in Finland

MFPC Meeting 9/18/2017

Petri Sirviö
Paper-, paperboard- and pulp industry in Finland

Population of Finland: 5.5 Million

Forests: 22.5 Million acre of which 9 % is strictly protected

10 acres of forest per capita

Sources: Finnish Forest Industries Federation, Statistics Finland, LUKE
Forest industry is one of the largest industries in Finland

Source: Statistics Finland, Finnish Forest Industries Federation
Finnish Forest Industry
Vision and target for 2030

Vision
Finland has a successful, constantly developing forest cluster, whose products and services are among the most sought after in the world. This will pave the way for a sustainable biosociety.

Target for 2030
The target is to double the value of forest cluster products and services from 2006 levels by 2030. At least half of the value will come from products and services that were not yet in production in 2006.

Source: Finnish Forest Industries Federation
The focal points of the research strategy

- **Innovative people, businesses and networks**
  - Operating within value networks
  - Entrepreneurship and internationalisation
  - Expertise across clusters

- **Customer and user as the drivers of development**
  - New ideas in living, packaging and media
  - New end uses for wood and fibre

- **Possibilities offered by new materials, services and business models**
  - Biomaterials for new and existing uses
  - Solutions combining product and service

- **Forest cluster as a builder of a sustainable bioeconomy**
  - Processes, machinery and operating models
  - Sustainable development

*Source: Finnish Forest Industries Federation*
Different kinds of innovations are needed at different points in the lifecycle of products and services.
Existing and new businesses

Existing products and businesses
- Cost competitiveness
- Effective structures and operating models
- Investments in the development of existing products, processes and technologies

New products and businesses
- New expertise
- Global networking
- R&D and innovations
- Investments in new technology and businesses
The innovation environment of the forest cluster has changed a lot in recent years.

- Research and development in companies
- Forest cluster research strategy
- Research programmes of Forest Cluster Ltd. and other strategic centres for science, technology and innovation
- Wood products industry research strategy
- Finnish Wood Research Oy research programmes
- International and European research co-operation – Forest Based Technology Platform

**Leading position of the Finnish forest cluster**

- 2007: Aalto University
- 2008: VTT and KCL join forces to form a strong forest industry centre of expertise
- 2009: Ministry of Employment and the Economy strategic programme for the forest sector
- 2010: Finnish Wood Research Oy is founded
- 2011: Finland’s first strategic centre for science, technology and innovation, Forestcluster Ltd., is founded
- 2012: European forest sector sets its research agenda

Source: Finnish Forest Industries Federation
Key change factors of the forest cluster operating environment

- Climate change
- Conflicts and disasters
- Content and origin of innovations
- Development of substitutes
- Genetic modification
- Energy and raw material availability and price
- Availability of financing
- People’s perceptions of the forest sector
- National political decision-making

Source: Finnish Forest Industries Federation
Forest industry investments in Finland

Sources: Statistics Finland, Forecast Confederation of Finnish Industries, Finnish Forest Industries Federation
Forest industry investments in Finland

<table>
<thead>
<tr>
<th>Company / Unit</th>
<th>Investment million €</th>
<th>Investment</th>
<th>Complete</th>
</tr>
</thead>
<tbody>
<tr>
<td>UPM, Lappeenranta</td>
<td>175</td>
<td>Biodiesel plant</td>
<td>2015</td>
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<tr>
<td>Stora Enso, Varkaus</td>
<td>110</td>
<td>Conversion of a fine paper machine to case materials, capacity increase at pulp mill</td>
<td>2015</td>
</tr>
<tr>
<td>UPM, Kymi</td>
<td>160</td>
<td>Capacity increase at pulp mill</td>
<td>2015</td>
</tr>
<tr>
<td>Stora Enso, Sunila</td>
<td>32</td>
<td>Biomill, lignin separation technology</td>
<td>2015</td>
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<td>Stora Enso, Varkaus</td>
<td>48</td>
<td>Wooden elements, LVL production line</td>
<td>2016</td>
</tr>
<tr>
<td>UPM, Kaukas</td>
<td>50</td>
<td>Capacity increase at pulp mill</td>
<td>2016</td>
</tr>
<tr>
<td>Kotkamills, Kotka</td>
<td>100</td>
<td>Conversion to cartonboard, pulp mill rebuilding</td>
<td>2016</td>
</tr>
<tr>
<td>North European Bio Tech Oy (NEB), Kajaani</td>
<td>40</td>
<td>Biorefinery, bioethanol production</td>
<td>2016</td>
</tr>
<tr>
<td>Metsä Group, Äänekoski</td>
<td>1 200</td>
<td>Bioproduct mill / softwood (NBSK)</td>
<td>2017 autumn</td>
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<td>Stora Enso, Imatra</td>
<td>70</td>
<td>Polyethylene (PE) extrusion coating plant and an automated roll warehouse</td>
<td>2017/Q4</td>
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<tr>
<td>UPM, Kymi</td>
<td>98</td>
<td>Upgrading pulp mill</td>
<td>2017 autumn</td>
</tr>
<tr>
<td>Metsä Group, Suomi and Estonia</td>
<td>100</td>
<td>Birch plywood mill in Pärnu, LVL line in Lohja and birch veneer mill in Äänekoski</td>
<td>2018</td>
</tr>
<tr>
<td>Stora Enso, Heinola</td>
<td>28</td>
<td>Increasing fluting capacity</td>
<td>2018</td>
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<tr>
<td>UPM, Kaukas</td>
<td>30</td>
<td>Upgrading pulp mill</td>
<td>2018</td>
</tr>
</tbody>
</table>

Sources: Finnish Forest Industries Federation, press releases of the companies

**Unconfirmed investments & projects:**

**Finnpulp Oy, Kuopio**
- Published in February 2015; a new company
- 1.4 billion euros, NBSK

**Boreal Bioref & Chinese CAMCE**
- Bio-refinery plant to Kemijärvi
- Investment decision in 2017, complete in 2020
- 780 million euros, 400 000 tonnes NBSK

**KaiCell Fibers Oy, Paltamo**
- Investment decision in 2018, complete 2020-21
- 800 million euros pulp mill project
- Capacity 460 000 tonnes

**Kaidi Finland, Kemi**
- Chinese company, biodiesel project, capacity ~ 200 000 tonnes
- 1 billion euros investment, complete in 2019

**Haapajärvi, biorefinery**
- Published in April 2016
- Biorefinery, NBSK ~400 000 tonnes
- Investment value 500 million euros

**North European Bio Tech Oy (NEB), Pietarsaari**
- Biorefinery, bioethanol
- Complete in 2020
- Letter of intent about location signed in 11-2016
- 140 million euros
Waste water emissions have decreased significantly per produced tonne since 1992

Source: Finnish Forest Industries Federation
Fossil CO$_2$ emissions have decreased significantly per produced tonne since 1990

Source: Finnish Forest Industries Federation
Forest industry has succeeded well in its water conservation efforts

Production of the pulp and paper industry in Finland and waste water load

Source: Finnish Forest Industries Federation
R&D expenditure in the Finnish forest industry*

Source: Finnish Forest Industries Federation
Products made of wood and fibre play a significant role in the low-carbon bioeconomy of the future.
Stora Enso in brief

Leading global provider of renewable solutions in packaging, biomaterials, wooden constructions and paper

Sales
EUR 9.8 billion
in 2016

Operational EBIT
EUR 884 million
in 2016

Some 25 000
employees in 35 countries

Stora Enso shares are listed on NASDAQ OMX Helsinki and Stockholm. In addition, the shares are traded in the USA as ADRs.
Our strategy is to transform to a renewable materials growth company.
A changing world
Global trends drive for renewable materials

Growing population
Urbanisation
Digitalisation

Income growth
Global warming
Changing lifestyles
Eco awareness
In a global scale there is an increasing drive towards sustainable packaging solutions
Majority of the portfolio is aimed at growth

Stora Enso 2016: Sales EUR 9 802 million/ Operational EBIT EUR 884 million/ Operational ROCE 10.3% / Operational ROCE excluding Beihai 13.0%

- **Consumer Board**
  - Expansion of relative market share in profitable niches

- **Biomaterials**
  - Strengthening current business and creating new profitable growth

- **Packaging Solutions**
  - Selective profitable growth

- **Wood Products**
  - Accelerating growth

- **Paper**
  - Strategy for maximum cash generation
Transformation journey
Growth businesses 70% of sales and 80% of operational EBIT

Sales 2006
-3%  21%  12%  70%
30%

Sales Q1/2017
30%  2%  24%  12%
70%

Operational EBIT 2006
-3%  35%  6%  62%
38%

Operational EBIT Q1/2017
6%  28%  10%  11%  25%
80%

- Consumer Board
- Packaging Solutions\(^{(1)}\)
- Biomaterials
- Wood Products
- Paper\(^{(2)}\)
- Other & eliminations

\(^{(1)}\) In 2006 included in Consumer Board
\(^{(2)}\) In 2006 includes merchants
Everything that’s made with fossil-based materials today can be made from a tree tomorrow.
Innovation

What is desirable to consumers?

What is viable in the market place?

What is possible technologically and scientifically?
Transformation in Action
Case: Bio Composites
Bio- and circular economy in action
Stora Enso Biocomposites

• Addressing challenges of climate change and scarce resources

• Utilisation of side-stream and recovered materials

• Targeted applications range from consumer goods to more industrial applications

• Direct substitution of oil-based plastics with renewable fibres and polymers

• Reducing total carbon footprint of final products

• Meeting increasing brand owner and consumer demands and regulations

• Utilisation of inherent strength of natural fibres to replace e.g. glass-fibre
Examples of biocomposite applications with related customer values

We offer value to our customers by:

- **Reducing the cost base for customers** - Provide cost-competitive alternative to virgin plastics with Bio Composite Granules
- **Reducing cycle time** - give the possibility to increase the productivity of existing injection molding equipment
- **Reducing CO2 footprint** - wood is more sustainable than fossil-based plastics
- **Customer Joint development** - together with customers to develop sustainable and competitive product
- **Improved price stability in raw material**
  **Increased price stability** - reduce exposure to the volatile plastic soil conditions

Examples on how we support customers

- We develop product and it's characteristics collaboratively with our customers to get the best results
- We support with marketing material that will contribute to increased sales for the entire value chain
Future Bio Composites
Project: High strength bio composites for technical applications

- HIPS (High Impact Polystyrene)-SMA-TW composites developed together with UMaine
- Excellent strength and stability results achieved
- Joint development and patent filed in U.S with UMaine
- Field trials starting with “InnovaSea Aquapods” based on our new technology
- High performance thin walled cladding & joinery products under development
- High performance coating and welding trials ongoing in Maine
Transformation in Action

Case: Wood based urban Construction systems
Building Solutions offering

• Starting with individual projects
  > 1500 delivered projects

• Optimized building systems
  > optimized use of CLT
• High level of industrial prefabrication

• Single family houses through partners
• Focus on urban industrial concepts
• B2B
Benefits of prefabricated massive wood elements (LVL and CLT)

- Prefabricated massive wood elements are one of the strongest wood-based construction materials relative to their weight—even stronger than steel (LVL)
- High load-bearing capacity and stiffness
- Dimensional accuracy
- Hygroscopic behaviour
- Ecology
Building Components by Stora Enso

- Massive wall panels
  Made of CLT/re-glued LVL

- Massive floor panels
  Made of CLT/LVL

- Ribbed slabs for floors & roofs
  Made of CLT/LVL

- Beam

- Post
Grow market demand and create an eco system

Stora Enso

Developers & Main Contractors

Architects & Engineers

Partners

Contractors & Suppliers

THE RENEWABLE MATERIALS COMPANY
Library at the Dock – CLT building in Melbourne
Building Solutions take wood to new heights

- Växjö, Sweden, apartment buildings, 7000m³ CLT
- Ris-Orangis, apartment buildings, Paris France, 1800m³ CLT
- Moholt 50|50, student homes, Trondheim, Norway, 6500m³ CLT
- International House Sydney, office building, Barangaroo, Australia, 2000m³ CLT
- Wood City, apartment buildings, Helsinki, Finland, 2600m³ LVL
- Crome Court, student accommodation, Norfolk, UK, 1680m³ CLT
- Geological research base, Svalbard, Norway, 300m³ CLT
- La Cité du Vin, wine museum, Bordeaux, France
Transformation in Action
Case: Biomaterials and bio-refining
Wood and other biomass are raw materials for new biomaterials and bio-based chemicals

Different fractions of these biomaterials can be extracted, refined and upgraded via chemical, mechanical and enzymatic processes and then made into new products.

Potential applications include polymers, chemicals, coatings, adhesives, textiles and food ingredients.
Biomaterials division focuses on four clusters in its innovation work:

1. Improving current pulp grades
2. Pulp applications
3. New technology for separating C5, C6 and lignin from biomass
4. Developing the extraction technology
5. Cellulose modification and pulp process by-products
6. Lignin, MFC, CCA and by-products development
7. Further development of sugars
8. Transforming C5, C6 into bio-based chemicals and chemical intermediates
Allu – a dress made of wood in Pure Dissolving Pulp

• One example of the applications for dissolving pulp is the clothing industry

• Enocell pulp mill produces 150 000 tonnes / year of dissolving pulp from birch wood

• Product development in collaboration with our customers
A global player
American operations

- Research & Development facilities
- Pilot/demonstration plants
- Pulp mills with shared ownership
- Plantations

Danville
Raceland (2017)
Veracel
Rio Grande do Sul
Montes del Plata
Transformation in Action
Case: Intelligent Packaging
Intelligent Packaging
Digitalizing your business throughout the supply chain
Intelligent Packaging

Consumer Engagement  |  Brand Protection  |  Supply chain management
Intelligent Packaging
We are an end-to-end partner

1. Solution design
   Customer needs, system topology, technology selection, data flow.

2. Package design
   Package structure, functionality, RF properties, electronics placement, features.

3. Tag design
   Tag design, selection, sourcing, qualification, quality control.

4. Personalization
   Tag programming, Variable Information Printing.

5. Integration
   Physical integration of tag into package.

6. Connect
   Cloud, data collection, data management.

7. Analysis
   Data analytics and dashboards.

8. Apps and Installations
   Customer-tailored smartphone apps, system installations – with partners.
Intelligent Packaging – Use-cases catered by Stora Enso

- Consumer engagement (NFC)
- Brand protection solutions (Tamper evident: NFC, Android)
- Analytics (Web Portal)
- Supply chain management – UHF
- RFID on packages
Transformation in Action
Case: Geographical growth
Source: CEPI
The Beihai board mill in China started-up in May 2016