The shaping of industrial scale bioeconomy
UPM perspectives

NOFOBE and NB-NORD Meeting
14–16 June 2017 in Lappeenranta, Finland
Heikki Ilvespää, VP R&D
VERSATILE
RENEWABLE
RECYCLABLE
SUSTAINABLE
NON-GMO
LOW MARKET VOLATILITY
COMPETITIVE
NON-FOOD
The shaping of industrial scale bioeconomy

Content

• The basis of bioeconomy
  – Renewable raw material, CO2 – cycle & availability

• The innovation challenge
  – Importance of system and balanced sectoral funding

• The transformation
  – Case: UPM – the Biofore Company

• The future
  – Sustainable forest success is our common task
Our planet has to provide increasingly more wellbeing to more people

- LONGER LIFE EXPECTANCY
- POPULATION GROWTH
- URBANIZATION
- CLIMATE CHANGE
- RESOURCE SCARCITY
- AGING POPULATION
- HIGHER LIVING STANDARDS

MORE WITH BIOFORE

SUSTAINABLE BIOALTERNATIVES & NEW BIOINNOVATIONS
FOREST INDUSTRY IS IN A UNIQUE POSITION

BIOMASS MANAGEMENT
knowledge & infrastructure

BIOMASS CONVERSION PROCESSES
knowledge & infrastructure

INDUSTRIAL SCALE
knowledge & infrastructure
Key words in the forest bioeconomy

- Carbon neutrality / footprint
- Sustainability/ renewable raw materials
- Circular economy / material and energy efficiency
- Wide use of biomass
- Growth and innovations
- New biobased businesses

84% of all wood and wood fibre used in UPM’s production units is certified.
Forest based Bioeconomy addresses climate change

Basics:

- Sustainable forest/biomass use is very close to carbon neutral
- Responsible forest industry has crucial role in reforestation & forest carbon storage management
- Biobased industry has potential to be carbon negative
- Lower fossil use lowers emissions in all industries
Challenge:
The digital media and advertising channels caused a paradigm shift in graphic paper demand.
The Challenge – Reshaping the industry by Innovations
EU recognises and funds “BIOMASS FOR GROWTH” PPP as a framework for sustainable renewal of the European industry.

PPP model has proven very effective in supporting bioeconomy development:

- Funding based on SRA and calls
- Basic research, demonstration and flagships are supported -> maximal impact
- Dynamic build-up of European consortia’s based on calls
PPP in operation with significant impact!
CLIC Innovation Oyj – Innovation Platform
Finland

Finnish private sector development platform - But no clear sectoral public funding...
UPM TRANSFORMATION

BIO+FORE
Our transformation

<table>
<thead>
<tr>
<th>2003 integrated paper company</th>
<th>2008 towards market-driven businesses</th>
<th>2015 six separate businesses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Paper</td>
<td>Paper</td>
<td>Paper ENA</td>
</tr>
<tr>
<td>Sawmilling</td>
<td>Raflatac</td>
<td>Biorefining</td>
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<tr>
<td>Plywood</td>
<td>Plywood</td>
<td>Raflatac</td>
</tr>
<tr>
<td>Raflatac</td>
<td>Speciality Papers</td>
<td>Energy</td>
</tr>
<tr>
<td>Sold units</td>
<td>Sawmilling</td>
<td>Other</td>
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</tbody>
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<tr>
<th></th>
<th>2003</th>
<th>2008</th>
<th>2015</th>
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</thead>
<tbody>
<tr>
<td>Sales</td>
<td>EUR 9.8bn</td>
<td>EUR 9.5bn</td>
<td>EUR 10.1bn</td>
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<tr>
<td>EBIT</td>
<td>EUR 429m</td>
<td>EUR 513m</td>
<td>EUR 898m</td>
</tr>
<tr>
<td>Net debt</td>
<td>EUR 4.9bn</td>
<td>EUR 4.3bn</td>
<td>EUR 2.1bn</td>
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<tr>
<td>Market cap</td>
<td>EUR 7.9bn</td>
<td>EUR 4.7bn</td>
<td>EUR 9.2bn</td>
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<tr>
<td>Personnel</td>
<td>34,500</td>
<td>25,000</td>
<td>19,600</td>
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</tbody>
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* excluding special items. EUR 265 million forest fair value increase in 2015 excluded for comparability.
UPM today

UPM BIOREFINING
Pulp
Plantations
Biofuels
Sawmills
Wood Sourcing
and Forestry

UPM ENERGY
Hydro-, nuclear-
and condensing power
(incl. shares in energy
companies)
Electricity production and
trading

UPM RAFLATAC
Label materials
for product and
information labelling

UPM SPECIALTY PAPERS
Fine and specialty
papers in China and
APAC
Labelling material
globally

UPM PAPER ENA
Magazine papers,
newsprint and fine
papers for various end-
uses

UPM PLYWOOD
Wisa® Plywood
and veneer products
UPM Grada®
wood material

UPM BIOCOMPOSITES
UPM ProFi
UPM Formi

UPM BIOCHEMICALS
Chemical building blocks
Lignin products
Biofibrils
Biomedical products

UPM's sales 2016
EUR 9,812 million
19,300
employees
in 45 countries

© UPM
“Digitalization as opportunity”

CASE: UPM METSÄNI

An application for forest owners
Biofuels, biochemicals and novel fiber based products are natural next steps in wood based value creation.
Lappeenranta Biofuels biorefinery started-up 2015
ValChem – UPM:n 18,5 M€ EU-project demonstrates industrial wood to chemicals concepts
Biochemicals Applications

- **PLASTICS**
- **FOOD**
- **COSMETICS**
- **PAINTS**
- **COATINGS**

TYPICAL APPLICATIONS FOR BIOCHEMICALS

- **ADHESIVES**
- **FIBERS**
- **AGRICULTURE**
- **INDUSTRIES**
- **MANY OTHERS**
Wood fiber based products expansion with huge growth potential

New end-uses

New Markets

Tissue

New products

Medical supplies

Composites

Sustainable hygiene products

Packaging

Cellulose based films

Special fibers, textiles, yarns
UPM Composites

10 Years UPM ProFl
REALITY: UPM biochemicals enabling development of new medical treatments

GrowDex®
cellulose based hydrogel for life science applications

3D Cell Culturing Matrix for e.g. Cancer Research

Membranes for e.g. Wound Care Applications
Reinventing our industrial scale product offering for the next century
Value through responsibility

Forests are full of life and opportunities

Conducting business responsibly

Thinking circular is thinking smart

Renewable and recyclable solutions

Respecting and engaging people

Sharing goals and prosperity with our stakeholders
External proof of our responsibility

The wood we use and our products are verified by third party certificates and ecolabels.

Our consistent efforts in responsibility have received recognition from several third parties and made us one of the industry leaders in several indices.
Our own global biodiversity programme maintains and increases biodiversity in forests as well as promotes best practices in sustainable forestry and wood sourcing.

Preserving biodiversity helps adaptation to potential impacts on climate change and maintains the health and strength of wildlife populations.

Our own forests have in a key role in research and development of our forestry operations.
Take aways

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Forest Bioeconomy
Land of the rising sun!