



The Biofore Company **UPM**

Energy dimensions and opportunities in forest based industry - UPM the Biofore Company

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THE FOREST OF NEW OPPORTUNITIES

**The world
is changing**

Resource scarcity
Change in
economic gravity
Climate change
Digitalisation

**Biofore – growth and competitive
advantage**

Material and energy efficiency
Renewable and
recyclable products
Innovations and new businesses

UPM today

UPM Plywood

- Plywood and veneer products



UPM Paper ENA

- Magazine papers in Europe and in North America
- Newsprint and Fine papers in Europe



UPM Biocomposites UPM Biochemicals



UPM Biorefining

- Pulp
- Plantations
- Biofuels
- Sawmills



Turnover 2014:
EUR 9,9 mrd

Personnel:
20 800

Shareholders:
90 000+

UPM Paper Asia

- Fine papers in China
- Labelling materials globally



UPM Raflatac

- Label materials for product and information labelling



UPM Energy

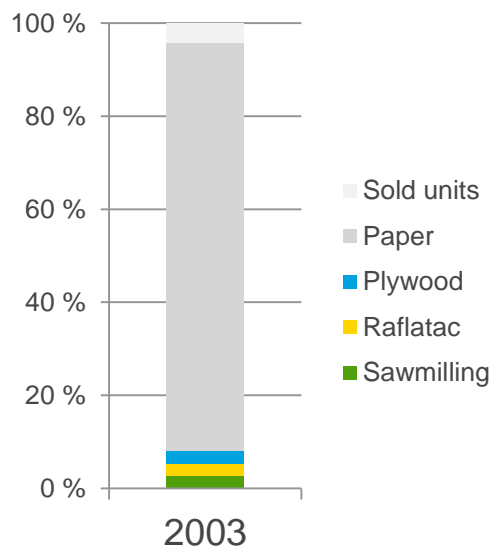
- Hydro, nuclear and condensing power generation
- Electricity trading in physical and derivatives markets



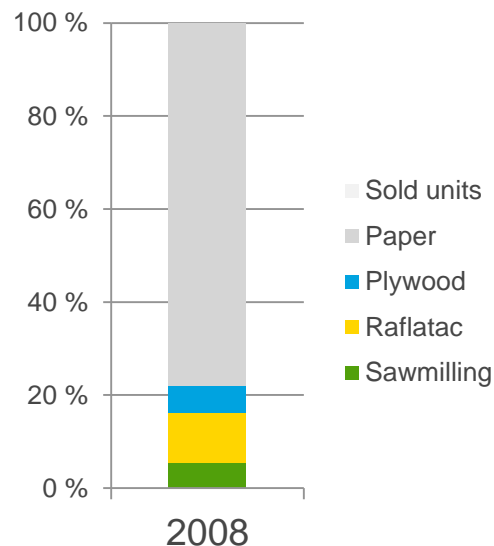
UPM in transformation

Business portfolio, sales

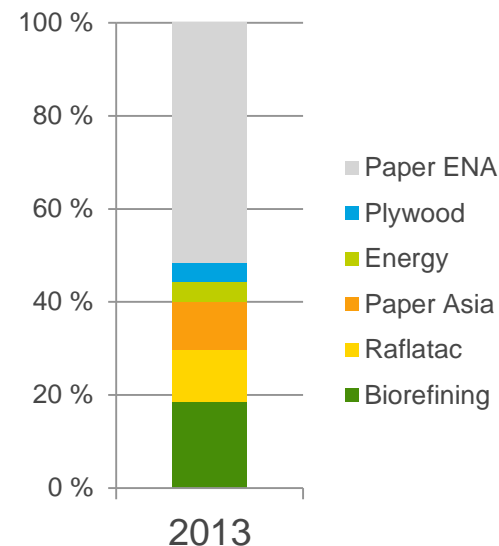
2003:
integrated paper company



2008:
towards market-driven businesses



2013:
six separate businesses



Sales	EUR 9.9bn
EBIT (*)	EUR 429m
Net debt	EUR 4.9bn
Market cap	EUR 7.9bn
Personnel	34,500

Sales	EUR 9.5bn
EBIT (*)	EUR 513m
Net debt	EUR 4.3bn
Market cap	EUR 4.7bn
Personnel	25,000

Sales	EUR 10.1bn
EBIT (*)	EUR 683m
Net debt	EUR 3.0bn
Market cap	EUR 6.5bn
Personnel	21,000

Integration of current operations and competencies into new knowledge and operations

Current businesses
&
competencies



New knowledge
&
new businesses



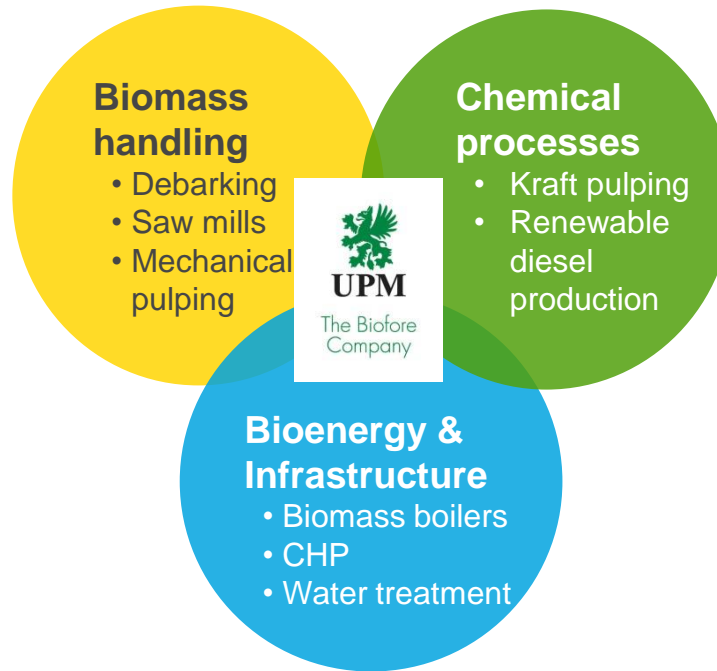
New
forest industry

An excellent position to integrate processes for new bioproducts

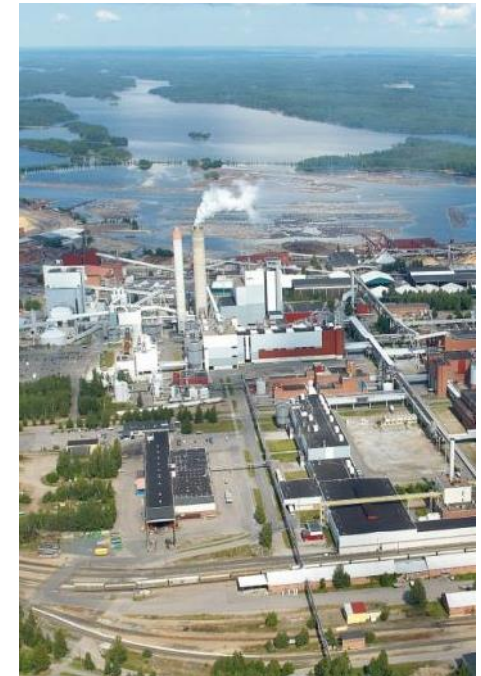
1) Access, management and sourcing of biomass



2) Processes of biomass conversion



3) Run sustainably large industrial processes



More with Biofore

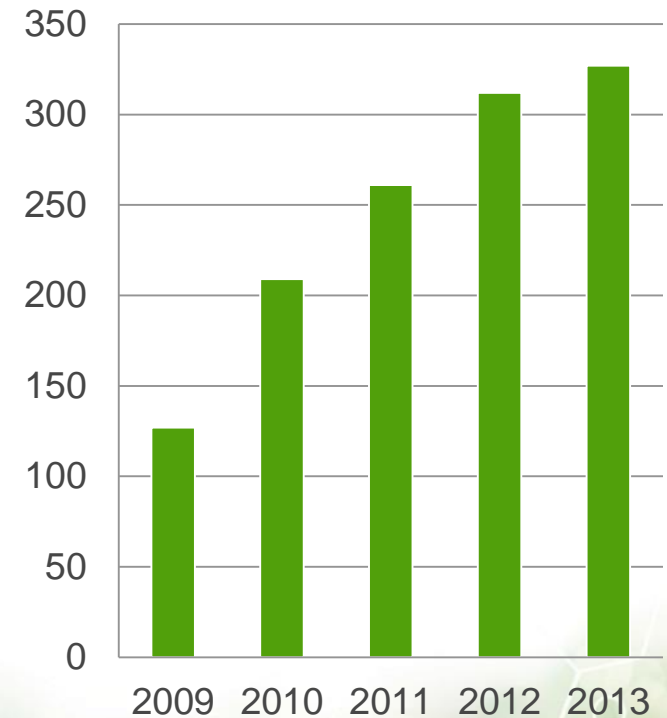
New businesses based on UPM's development and innovation work



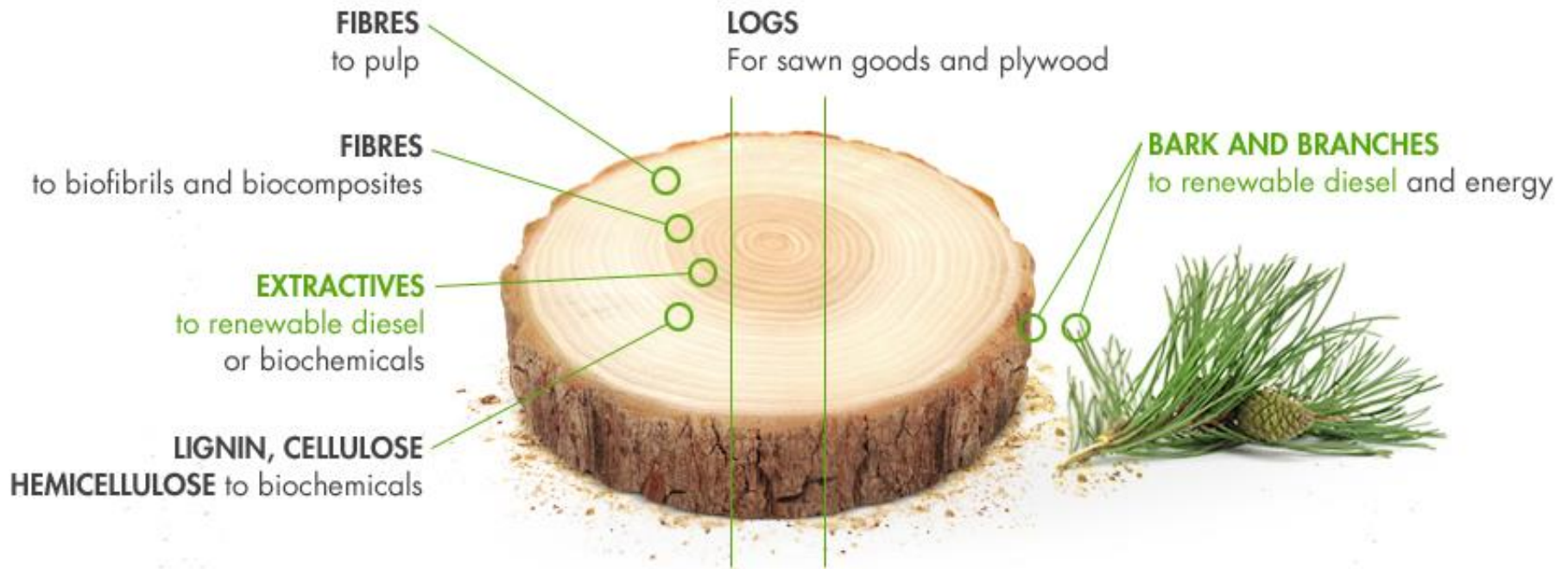
The Biofore Company UPM

- Large target markets with potentially healthy profitability
- Sustainable competitive advantage based on IPR
- **Biofuels** renewable drop-in diesel suitable for all diesel engines
- **Biochemicals** sustainable drop-in alternatives for oil-based chemicals
- **Biocomposites** for injection moulding to replace oil-based raw materials

Annual patent filings 2009–2013



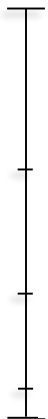
Wood raw material is the basis of many different businesses at UPM



Raw material: Crude Tall Oil (CTO) - Cellulosic residue from pulp production

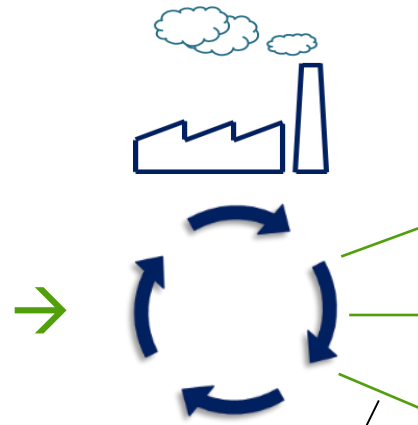
- Pulping process separates pulp fibers from wood via chemical processing.
- CTO must be removed from the chemical cycle to secure pulping process functionality.
- **CTO is not the primary aim of the process but the only practical way to run the process.**
- CTO is produced from 100% lignocellulosic feedstock.

SOFTWOOD



40% Cellulose
30% Hemicellulose
25% Lignin
5% Extractives

PULPING PROCESS



Extractives must be removed from process
(20 – 50 kg/t_{pulp})

PROCESS OUTPUT / END USE

50%

**PRIMARY PRODUCT:
PULP FOR PAPER,
BOARD & TISSUE**



48%

GREEN ENERGY

2%

**RESIDUE STREAM:
CRUDE TALL OIL**



BIOREFINERY

Biofuels investment: Capturing synergies by full integration into UPM Kaukas mill site in Lappeenranta, Finland



The Biofore Company UPM

- 1 RESEARCH CENTRE
- 2 PAPER MILL
- 3 BIOMASS POWER PLANT
- 4 PULP MILL
- 5 SAW MILL
- 6 BIOFUELS



Key facts:

Production of renewable diesel (pure hydrocarbons) from CTO

Investment: 175 mio €

Capacity: 100.000 to

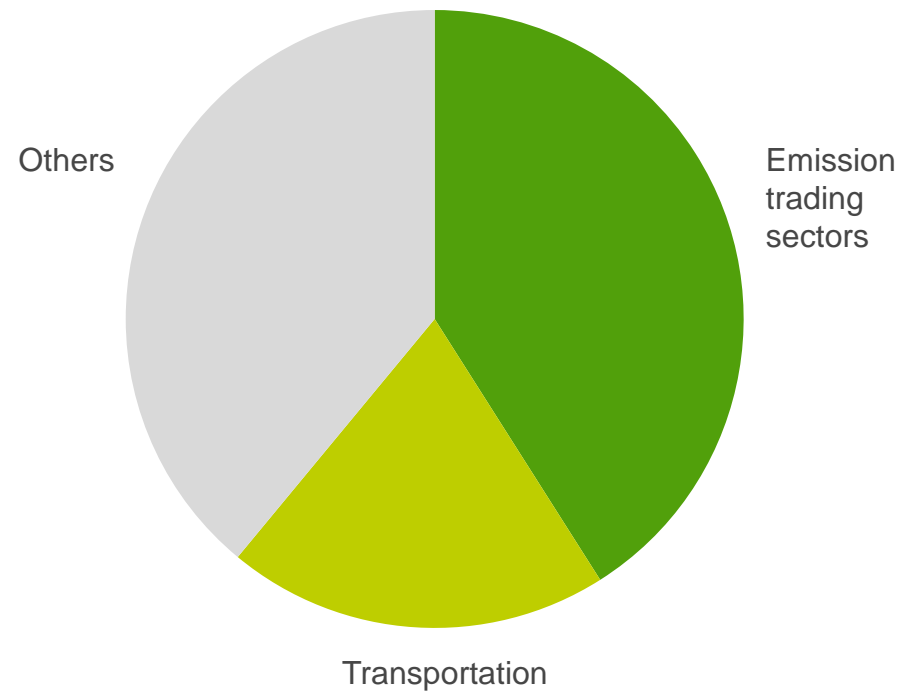
Commissioning: 2014



Long-term and ambitious biofuel policies

- In the future about a quarter of EU's CO₂ emissions comes from traffic, the only growing emission source
- Finland is a global pioneer in the development and production of high-quality advanced biofuels
- Transport sector calls for far-reaching emission reduction target
 - The current goal acted as an effective guidance tool
 - Increased business environment predictability

EU CO₂ emissions 2012





Energy efficient production and consumption

Versatile and CO₂ –efficient energy assets

Business opportunities

Sustainable energy has several dimensions in UPM

Energy as a production commodity at the wood processing mills

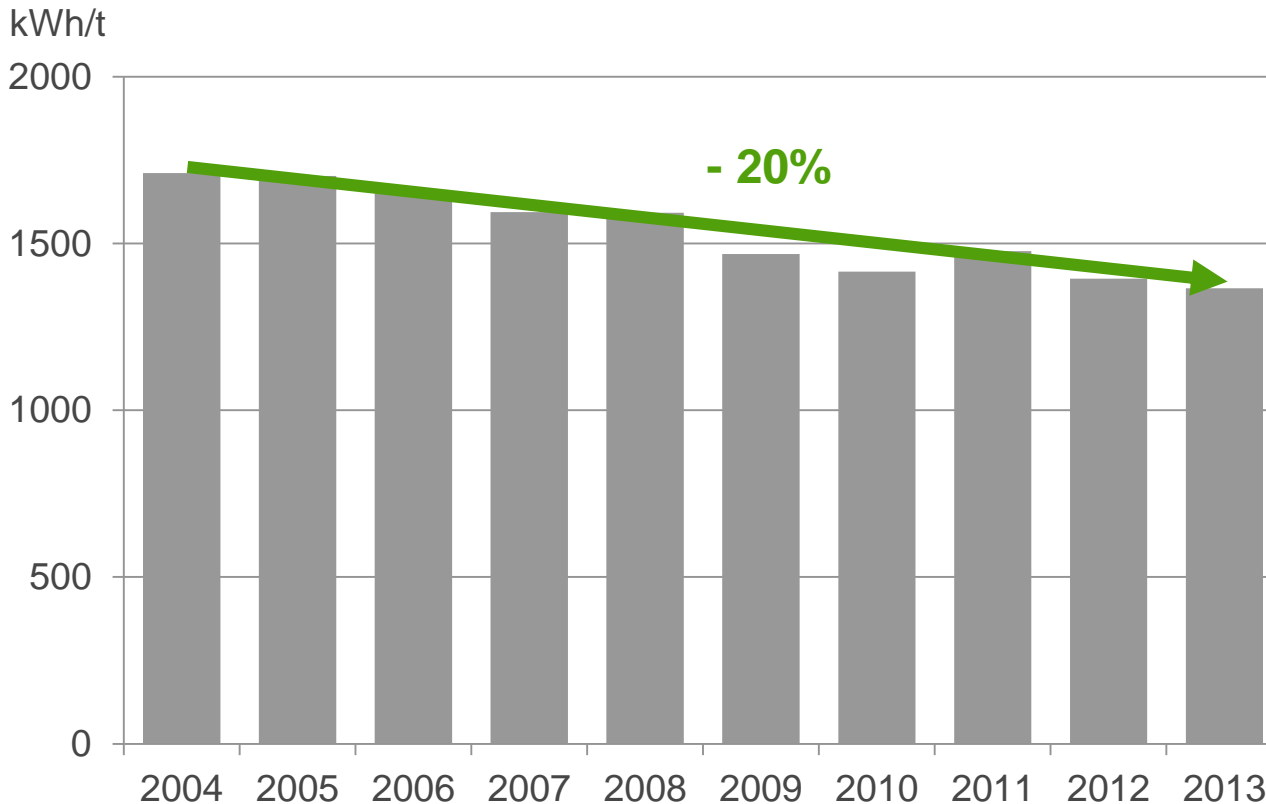
- Precondition
 - Availability 24/7
 - Functioning of the markets
- Remarkable cost
 - Market price + taxes + grid cost + renewables fee + CO₂
 - Natural incentive for energy efficiency audits and investments
- Strategic procurement decisions
 - Investment alternatives
 - Available market instruments

Energy as a business opportunity for the Biofore company

- Electricity business
 - Asset management and cost efficiency
 - Physical hourly trading in the market
 - Financial trading and hedging
 - Growth opportunities
- Sustainable Biofuels
 - Regulation and policy development
 - Sustainable raw material opportunities
 - Technology and IPR
 - Growth opportunities

Energy efficient production and consumption

UPM's electricity consumption per tonne of paper







- Energy audits
- 240 energy saving projects

The 2011 figures include data from former Myllykoski mills for 5 months, from August to December

Versatile and CO₂ –efficient energy assets


UPM Energy is significant producer of low emission energy in Finland

	Hydro	Nuclear	Condensing	Wind
Asset type				
Asset description	<ul style="list-style-type: none"> - 8 own hydro power plants - 61% in PVO Vesivoima - 19% in Kemijoki volume - 51% in LSV - 50% in Kainuun Voima 	<ul style="list-style-type: none"> - 45% in whole PVO - PVO holds 57% of Olkiluoto 1&2 and 60% of Olkiluoto 3 	<ul style="list-style-type: none"> - 45% in whole PVO, which owns biomass and fossil-fuelled thermal power plants in Finland - 50% of Kainuun Voima 	<ul style="list-style-type: none"> - Shares in Innopower
Total capacity	707 MW	581 MW	431 MW	<2 MW
Share of capacity	41%	34%	25%	< 1%

Annual production around ~9 TWh, of which clear majority is nuclear and hydro

Business opportunities

UPM Biofuels Strategy



Renewable fuels	<ul style="list-style-type: none">• Drop-in fuels fully compatible with all vehicles and fuel distribution systems
Wood-based raw materials	<ul style="list-style-type: none">• Renewable wood-based raw materials not suitable for food production
Sustainable operations	<ul style="list-style-type: none">• Sustainable supply chain• Low emission products

UPM will become a major player in advanced biofuels
Revenue target > 1 billion €/a



Energy efficient production and consumption

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Business opportunities



UPM

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