



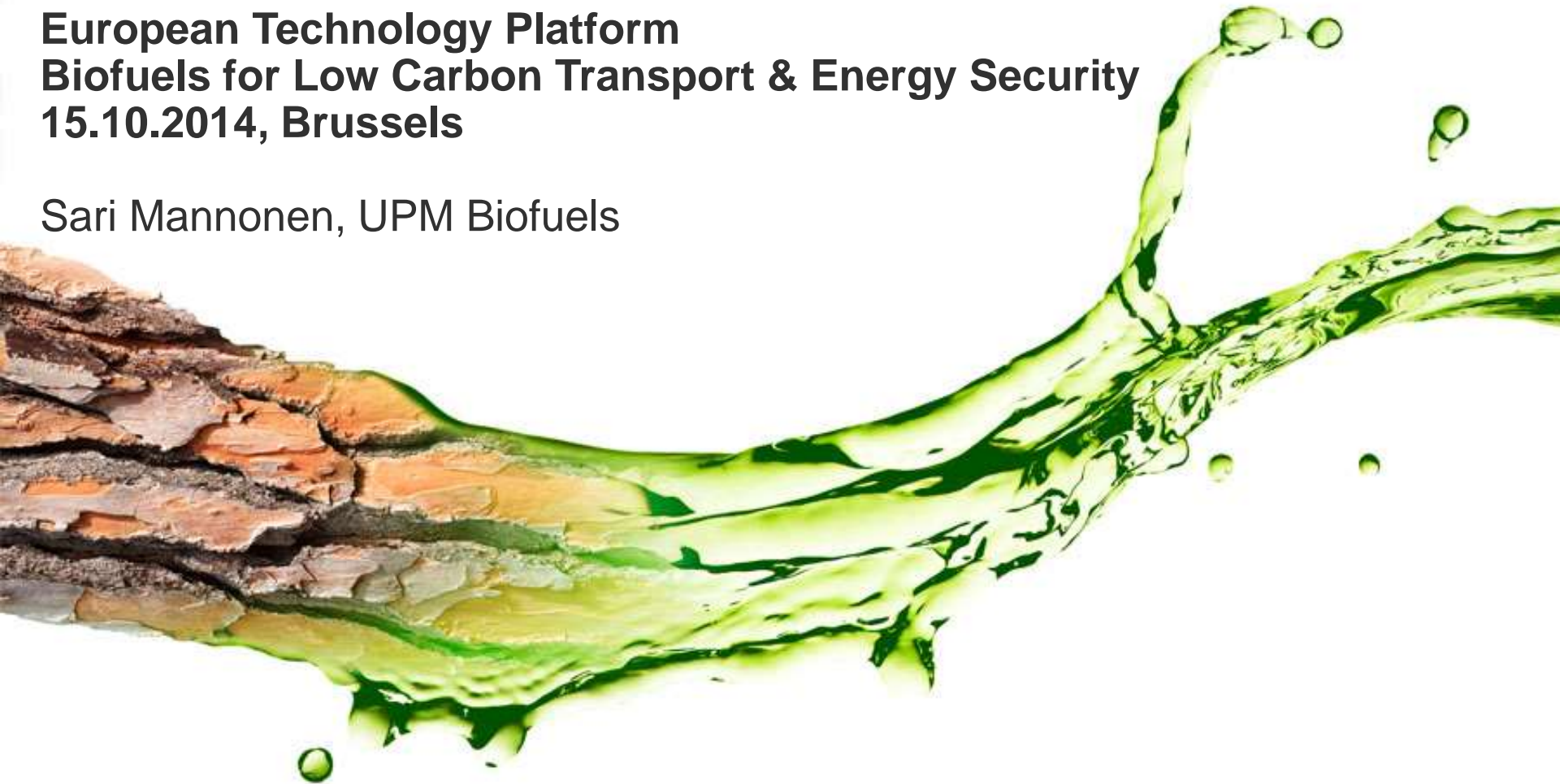
The Biofore Company UPM

UPM BIOFUELS

Biofuels from wood-based raw materials

**European Technology Platform
Biofuels for Low Carbon Transport & Energy Security
15.10.2014, Brussels**

Sari Mannonen, UPM Biofuels



UPM – The Biofore Company

UPM Biorefining



UPM Energy



UPM Raflatac



UPM Paper Asia



UPM Paper Europe



UPM Plywood



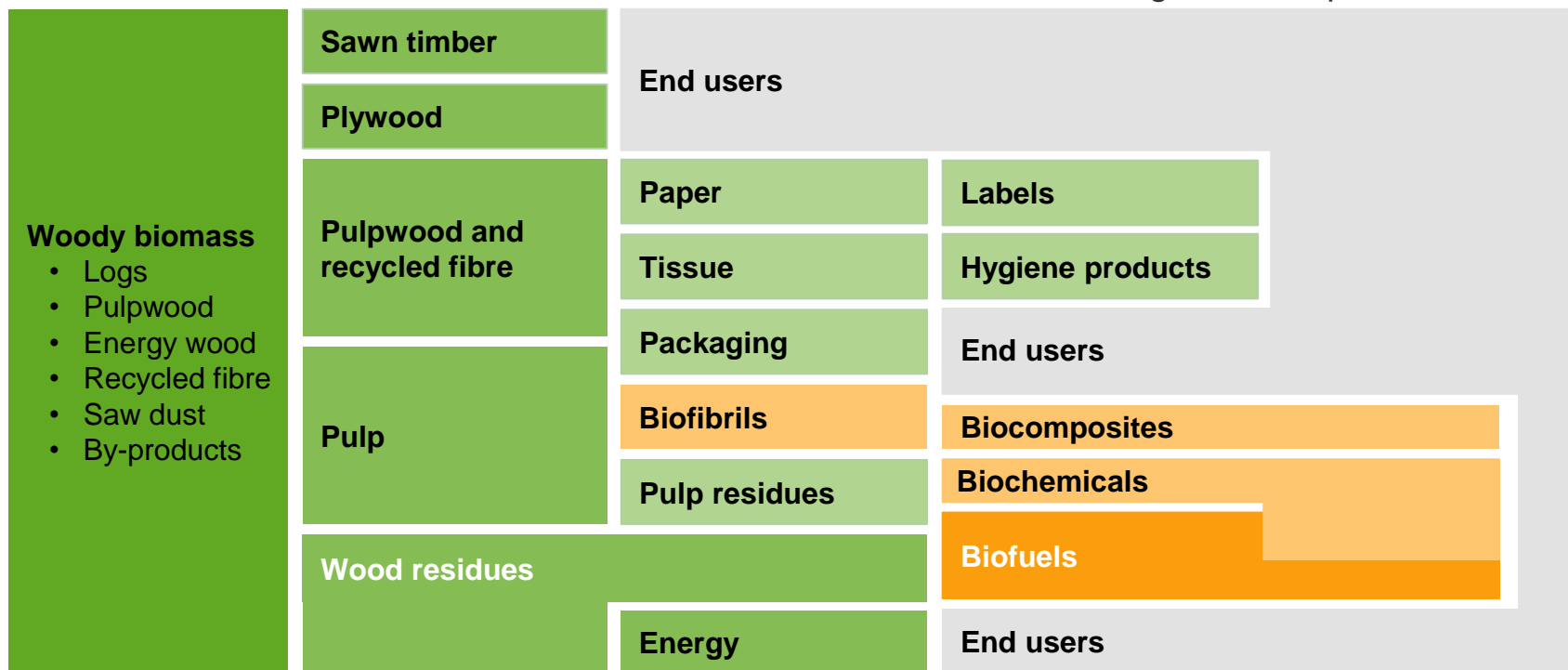
UPM leads the integration of **bio and forest industries** into a new, sustainable and innovation-driven future

- 21,000 employees
- Sales exceeds 10 billion euros in 2013
 - Production in 17 countries
 - Worldwide sales network
 - Listed in the NASDAQ OMX Helsinki stock exchange
- UPM Biofuels is a strategic business unit of UPM Biorefining



Biofuels a key step on pulp and paper industry's transformation path towards biorefining industry

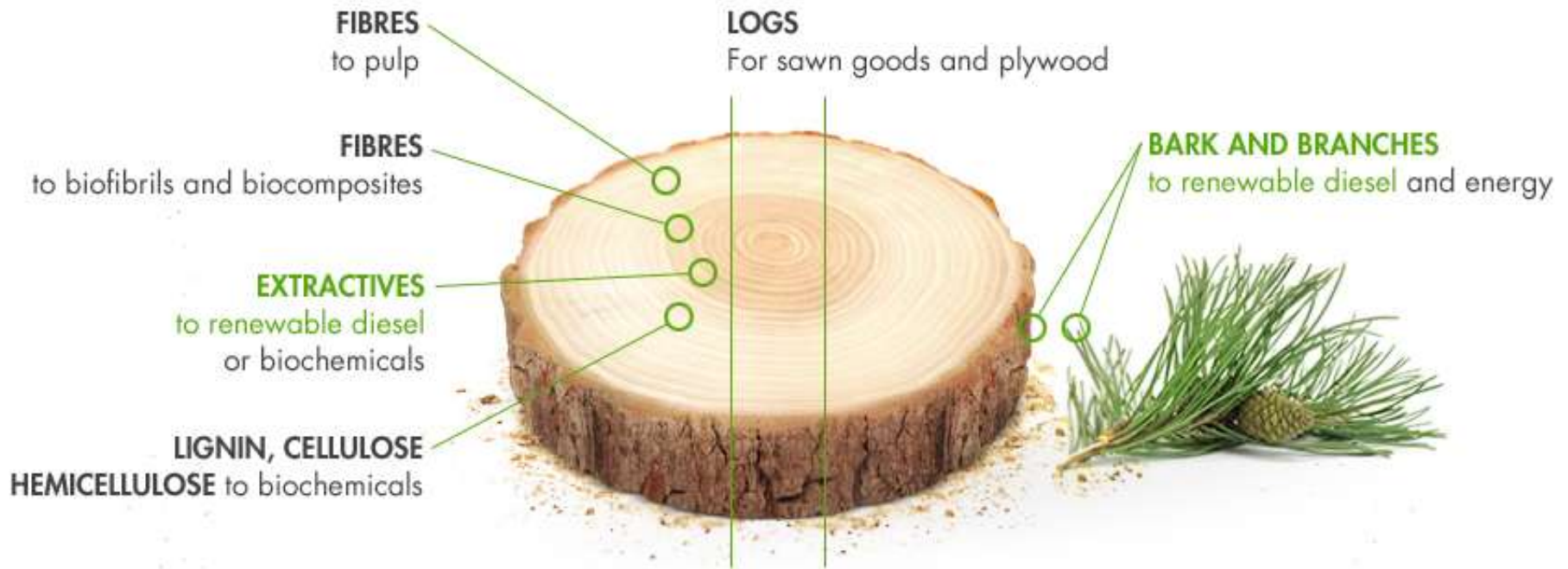
< **Pulp and paper industry today:** Relatively low value-adding products mostly from primary raw materials >
< **Biorefining industry of tomorrow:** High value-adding products with all materials, including residues, processed >



Current focus areas

Future growth avenues

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



Sustainability is in the core of our operations

- Wood is a renewable and recyclable raw material
- Sustainable forest management
- Good forest management practices
- Environmentally and ecologically sound harvesting
 - State-of-the-art techniques
 - Qualified personnel
 - According to PEFC or FSC standard
 - All UPM owned forests are certified
- Certified fibre to highest possible degree and promote a global increase in the use of **certified wood**
- Origin of all wood is known, legal and not from high conservation value forests
- All wood supplies covered by a third-party verified **chain of custody**



UPM Biofuels and latest sustainability recognitions



UPM renewed its position as the industry leader in Dow Jones Sustainability Indexes for 2014-2015



Award for Breakthrough Innovation in Technology in 2013




Shortlisted in Sustainability Product Innovation category in 2013



Winner in Travelling category 2014 awarded by European Commission



Finalist in Sustainable Innovation category in the Leading Technology Award 2014



Advanced biofuels	<ul style="list-style-type: none">• Drop-in fuels fully compatible with current vehicle engines
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">• Significantly, even 80%, less greenhouse gas emissions

**UPM will be a big player in advanced biofuels market
Revenue targeting > 1 billion €/a**



First step: UPM Lappeenranta Biorefinery

UPM Lappeenranta Biorefinery – commercial scale investment



Key facts:

- Product: Renewable diesel
- UPM investment: 150 M€
- Capacity: 100,000 tonnes/a
- UPM Patents & Applications: 150
- Commissioning: Summer 2014
- Employment: 200 persons
- Contributes approximately 25% of Finland's biofuel target



Raw material: Crude Tall Oil (CTO)

Residue of pulping process

No increase in harvesting or land use

Outside food value chain

- Contains natural extractives of wood
- Yield 20–50 kg CTO/t pulp
- Global production > 2 000 000 t/a
 - CTO supply potential above demand globally and increasing
 - Significant share burned for energy
 - Production potential 2 600 000 t/a
- UPM tapping into underutilized lower grade CTO streams
- UPM biorefinery minor addition to total demand, no effect on demand-supply balance



Crude Tall Oil (CTO) – a residue of pulp making process



UPM renewable diesel process



CRUDE TALL OIL

A residue of chemical pulping process containing natural extractive components of wood.

PRETREATMENT

Crude Tall Oil is purified: salts, impurities, solid particles and water are removed.

HYDROTREATMENT

Pretreated Crude Tall Oil is fed together with make-up and recycled hydrogen to the reactor where the chemical structure is modified. Reaction water is separated and directed to waste water treatment.

FRACTIONATION

Remaining hydrogen sulfide and uncondensable gases are removed. The remaining liquid is distilled to separate renewable diesel.

RENEWABLE DIESEL

High quality advanced biofuel suitable for all diesel engines.

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

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



UPM Lappeenranta biorefinery, Finland



UPM BioVerno – Renewable drop-in diesel suitable for all diesel engines



RENEWABLE
RAW MATERIAL

100 %



CO2 EMISSIONS
(VS. FOSSIL FUEL)

-80 %




HYDROCARBON FUEL,
COMPATIBLE WITH
DIESEL STANDARD EN590

100 %



Long term fleet tests completed with VTT

- Fleet testing with 20% UPM BioVerno renewable diesel with 4 Volkswagen cars
- 20.000 km/car
- Summer and winter conditions, various distances
- Independent testing by experienced test drivers of Technical Research Centre of Finland (VTT)
- Investigating fuel functionality in engine, emissions and fuel consumption
-  Functions as fossil diesel
- Phase 2: heavy duty vehicles test (busses)





The Biofore Company **UPM**



UPM Biofuels Growth Strategy and Competitive Edge

UPM Biofuels growth strategy

**ENTERING
BUSINESS**



HYDROTREATMENT

Tall oil > UPM Lappeenranta Biorefinery start-up 2014

**EXPANDING
BUSINESS**



THERMAL CONVERSION

Solid wood materials > Gasification (BtL) /Pyrolysis

**GROWTH OF
BUSINESS**



FUTURE DEVELOPMENT

New technologies, processes & raw materials

R&D activities & co-operation with strategic partners

Products are drop-in hydrocarbons – Ready components for commercial blends

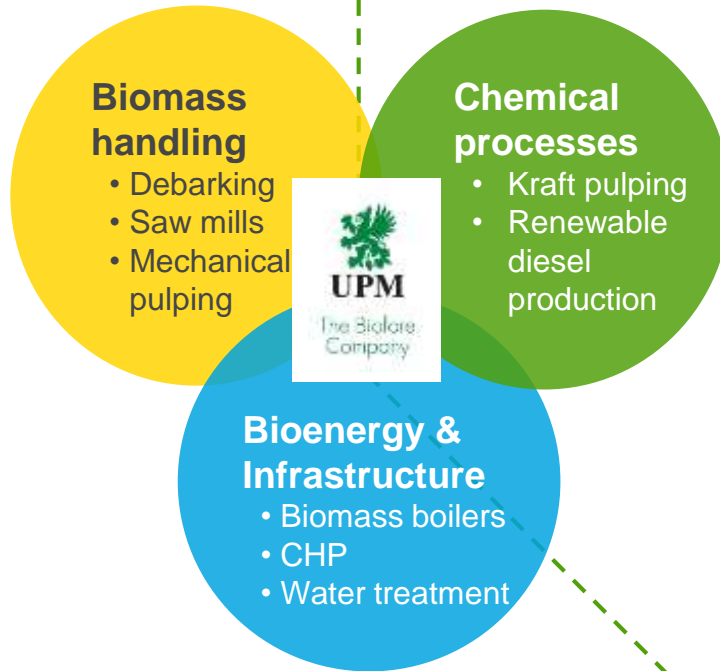
UPM is in an excellent competitive position to integrate processes for new bioproducts

Three areas of competence bring UPM in the position to become the frontrunner in new biomass based innovations

1) Access, management and sourcing of biomass



2) Processes of biomass conversion



3) Run sustainably large industrial processes



core competences of chemical companies



UPM's competitive edge in biofuels

Competitive raw-material	Efficient process	High quality product
<ul style="list-style-type: none">• Part of the UPM ecosystem• Optimise wood fractions to right products• Steady supply• Outside food value chain• No indirect land-use change• Meets sustainability criteria	<ul style="list-style-type: none">• Technology based on UPM and partner's innovations & know-how• Efficient use of raw material• Integrate synergies<ul style="list-style-type: none">• Industrial infrastructure• Energy	<ul style="list-style-type: none">• 2nd generation hydrocarbons• Compatible with current fleet and standards• 80% reduction in greenhouse gas emissions• High energy content• No blend wall limitations



Driver's seat in advanced biofuels





UPM

The Biofore
Company