

Fuels of the future - from wood-based raw materials



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UPM Biofuels
Sari Mannonen, sari.mannonen@upm.com





UPM today – The Biofore Company

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

- 24,000 employees
- Sales exceed 10 billion euros in 2011
 - Production in 16 countries, world-wide sales network
 - Listed in the NASDAQ OMX Helsinki stock exchange

Energy and pulp 4,200 employees	Paper 14,000 employees	Engineered materials 5,200 employees
Business areas <ul style="list-style-type: none">• Energy• Pulp including Plantation operations• Biofuels• Timber• Forestry and Wood sourcing	Paper grades <ul style="list-style-type: none">• Magazine papers• Fine papers• Newsprint• Selected speciality papers	Business areas <ul style="list-style-type: none">• Label• Plywood• UPM ProFi composite

Megatrends and regulations as the basis for the biofuels market

Megatrends...

Energy security



- Political, geographical and price risks

Climate change



- EU as forerunner

Rural development



- Employment in rural areas
- Land use

Energy prices



- Cost for marginal barrel of oil increases

...drive public policy...

Current regulation favourable

- Blending mandates and targets (EU: Renewable energy and fuel quality directives. US: Renewable fuel standard)
- Financial subsidies, mainly tax advantages

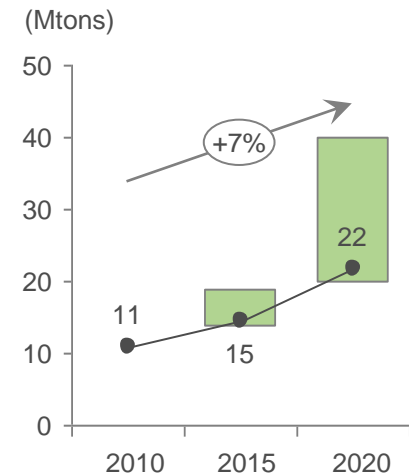
Major short-term regulation changes unlikely

- Biofuels needed to fight the megatrends
- Stable regulatory environment required to drive investments

Long-term, biofuels are likely to become competitive against fossil fuels as technology matures and oil price increases

... and Biofuels market

EU-27 biodiesel demand



UPM's plan (Mtons)

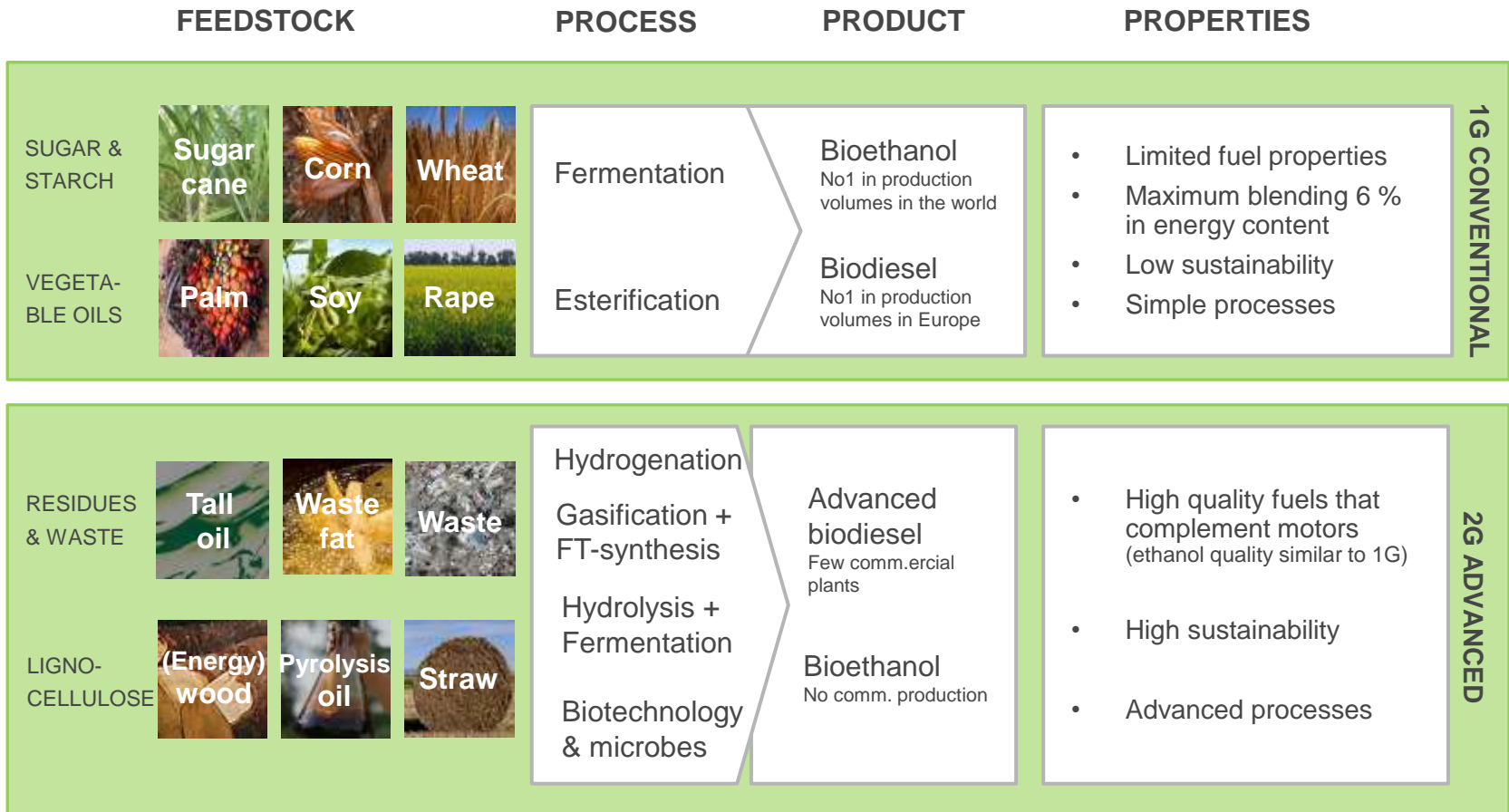
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■ Consensus range

● National action plans (NREAPs)


Biofuels concepts



UPM FOCUS

2G Biofuels favoured => Factor 2 (or 4) in quota calculations

UPM Biofuels strategy

	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 which are not suitable for food production
	Sustainable operations	<ul style="list-style-type: none">• Significantly, even 80%, less greenhouse gas emissions

UPM recognised as Supersector Leader in the Dow Jones Sustainability Indexes



- UPM was listed **as the only forestry** and paper company worldwide in the Dow Jones Sustainability Indexes
- UPM was chosen as an index component for both the **European and the World Sustainability Index for 2012-2013**
- UPM was assessed as the best company in the environmental dimension within the Forestry & Paper sector



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

Fibres to pulp,
paper and composites

Bark and branches to
BTL (next generation
biodiesel) and energy

Lignin and fibrils
to new
products

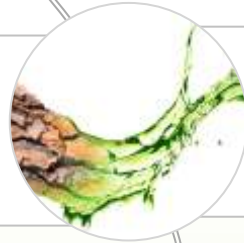
Extractives
to Biodiesel

Logs for sawn goods
and plywood



UPM biofuel concepts

FIRST STEPS OF BUSINESS



HYDROTREATMENT

Liquid raw materials → Tall oil
First investment → Lappeenranta biorefinery

EXPANDING BUSINESS



THERMAL CONVERSION

Energy wood → Gasification (BTL) / Pyrolysis
BTL investment → Strasbourg or Rauma

GROWTH OF BUSINESS



FUTURE DEVELOPMENT

New technologies, processes and innovative raw materials. UPM's own R&D activities in Lappeenranta and co-operation with strategic partners.

Products are drop-in advanced biofuels – ready components for car fuel tanks

UPM Lappeenranta biorefinery

- **Commercial scale industrial investment**
 - Total investment approx. 150 M€
 - Production 100 000 tonnes/a of advanced biodiesel -> 120 million litres
 - Production starts in 2014
 - Employs total approx. 200 persons directly and indirectly
- **Profitable investment**
 - Know-how and volumes in raw material procurement and logistics
 - Mill integrated synergies in energy and infrastructure
 - High quality product
 - UPM's innovative technology (technology partner Haldor Topsøe)



Growing UPM Kaukas mill site in Lappeenranta

1 RESEARCH CENTRE

2 BIOREFINERY

3 BIOMASS POWER PLANT

4 PULP MILL

5 SAW MILL

6 PAPER MILL



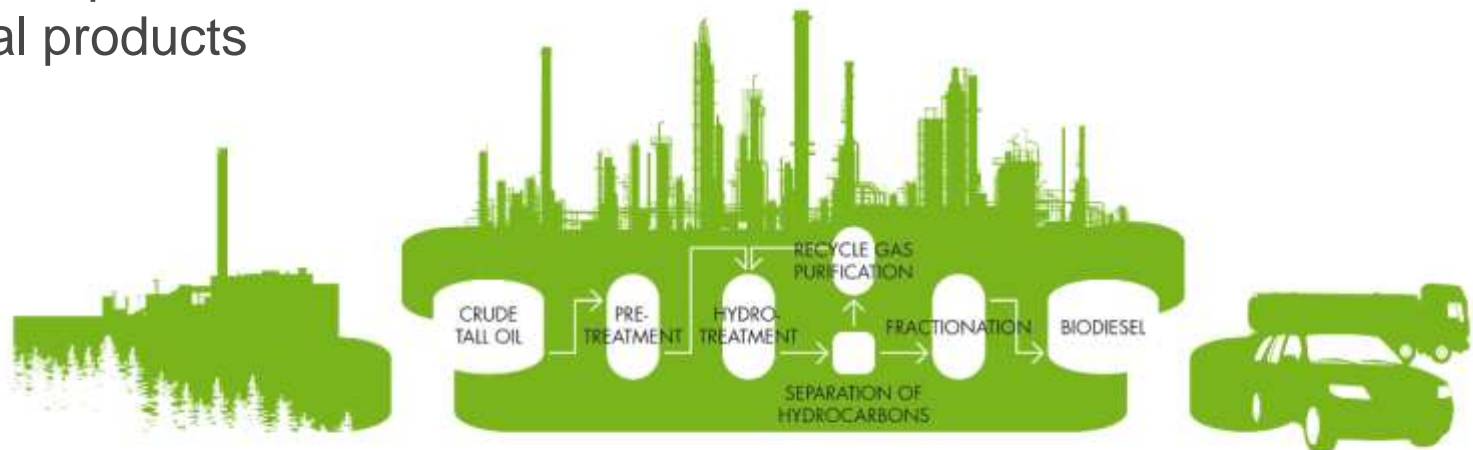
Raw material - Crude Tall Oil (CTO)

- Tall oil is a residue of pulping process
- Contains extractive components of wood
- Distillation derivatives
 - Tall Oil Fatty Acid TOFA
 - Tall Oil Rosin Acid TOR
 - Tall Oil Pitch TOP
- Manufactured by acidulating raw sulphate soap separated from black liquor
- Yield 20–50 kg CTO/ t pulp
- Global production now > 1 500 000 t/a
- Additional soap potential remarkable
- Utilization of low grade CTO



Lappeenranta biorefinery process - based on UPM's own innovations

- Metals and water are removed in the pretreatment section
- The chemical structure is modified by hydrotreatment
- Gases separated from liquid phase are purified and recycled back to the process
- The liquid phase is distilled to get final products



Sustainably produced biodiesel with identical properties as fossil diesel

- Main product is a unique, advanced biodiesel
 - Blend is compatible with fossil diesel EN590 standard quality
 - can be used as high as 30% blends in fossil diesel
- Fully compatible with current diesel motors and fuel distribution network
- Product has been tested in engine tests e.g. in independent German research centre FEV*
- UPM innovation which reduces greenhouse gas emissions of transport as much as 80% when compared to fossil fuels

FEV = Forschungsgesellschaft für Energietechnik und Verbrennungsmotoren GmbH





UPM BioVerno



Attractive growth investment based on UPM's competitive advantages

Competitive raw material

- Crude tall oil, a residue from pulp production
- Steady supply partially from own sources
- Outside food value chain
- No indirect land-use change

Efficient production process

- Technology based on UPM innovations
- Efficient use of raw material
- Integrate synergies
- Industrial infrastructure

High quality product

- 2nd generation biodiesel fully compatible with current diesel motors
- 80% reduction in greenhouse gas emissions
- High energy content
- No blend wall issues

UPM develops BtL biodiesel technology

- Raw material is sustainably sourced forest energy wood: logging residues, woodchips, stumps, bark
 - Collected without increasing wood harvesting
 - No change in indirect land-use (ILUC)
 - Added value for wood biomass
- Technical concept has been finalised at the Gas Technology Institute's pilot plant in Chicago together with Andritz/Carbona
 - Gasification technology
- Annual scale
 - Input appr. 1 million tonnes of wood biomass, output 100 000 tons of biofuel
 - Main product 2nd generation biodiesel



UPM develops BtL biodiesel technology

- UPM plans to invest in BtL biodiesel production adjacent to an existing UPM pulp & paper mill
- UPM has applied for EU NER300 grants both in Rauma, Finland and in Strasbourg, France
 - UPM has been shortlisted in evaluation: Strasbourg in top-ranked projects, Rauma on reserve list (2nd ranked project)
 - The investment decision will be made after the EU's grant decisions are announced by the end of year 2012
- The investment decision will be significantly impacted by the long-term outlook for wood price and availability in the market



EU NER300 = New Entrants Reserve. The purpose of this programme is to finance and advance new renewable energy technology and it is funded from the sale of emission allowances in Europe. NER300 is also one of the political decisions targeted for reducing Europe's carbon footprint. Total fund EUR 1.3 – 1.5 billion.

UPM's vision for Biofuels business

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

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Refining liquid feedstocks

- Sustainable wood based raw materials
- Hydrogenation
- Lappeenranta biorefinery 1st step

2

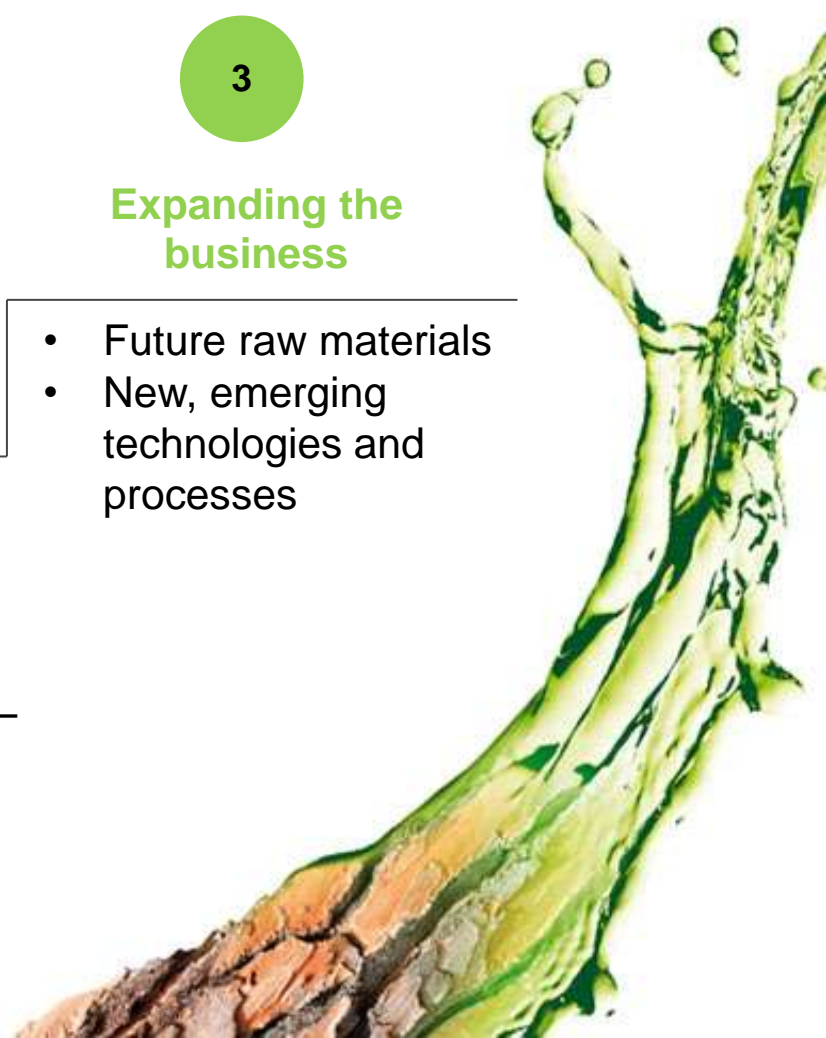
Refining solid feedstocks

- Energy wood as raw material
- Process e.g. BTL*) meaning gasification and Fischer-Tropsch – synthesis
- Rauma or Strasbourg as first choices of location

3

Expanding the business

- Future raw materials
- New, emerging technologies and processes





The Biofore Company **UPM**

Sustainable biofuels are an essential part of UPM – The Biofore Company





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Company