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# **Transformative business opportunity in molecular bioproducts**

Jyrki Ovaska  
EVP, Technology  
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# New horizons in bioeconomy



## Biomolecules

Biofuels  
Biochemicals



## Fibres

Pulp  
Paper  
Packaging  
Tissue  
Labelling materials  
Biocomposites



## Logs

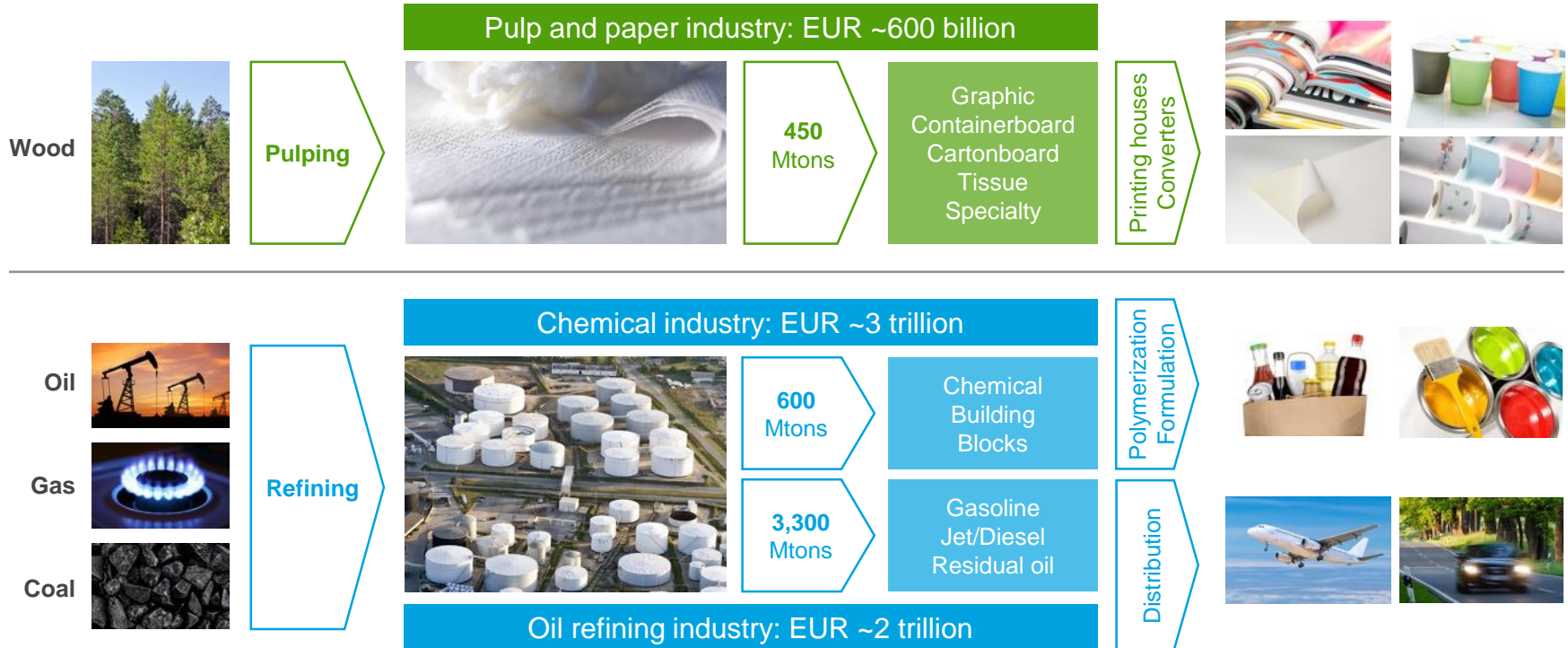
Sawn timber  
Plywood



## Trees

Energy

# Chemical and fuel value chains are much larger than pulp and paper opening value creation opportunities



# UPM has an excellent position for the attractive biomolecules opportunities

Huge and growing fuels and chemicals markets



Increasing demand for sustainable alternatives



Biofuels

Replacing fossil  
materials



Biochemicals

Competitive forest industry platform and access to sustainable feedstocks



Disruptive innovations and long-term perspective



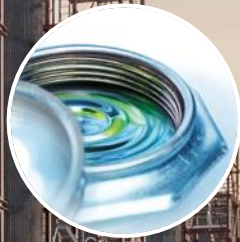
# Driving cleaner traffic



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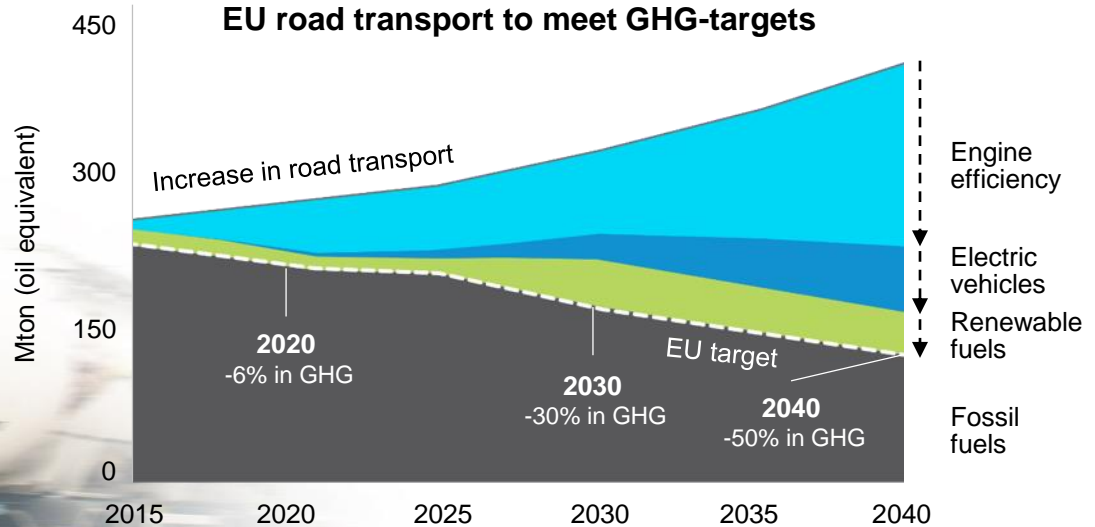
UPM BIOFUELS



# Renewable fuels are needed in road transport energy mix to meet EU's GHG-reduction targets



### Required fossil oil displacement in EU road transport to meet GHG-targets

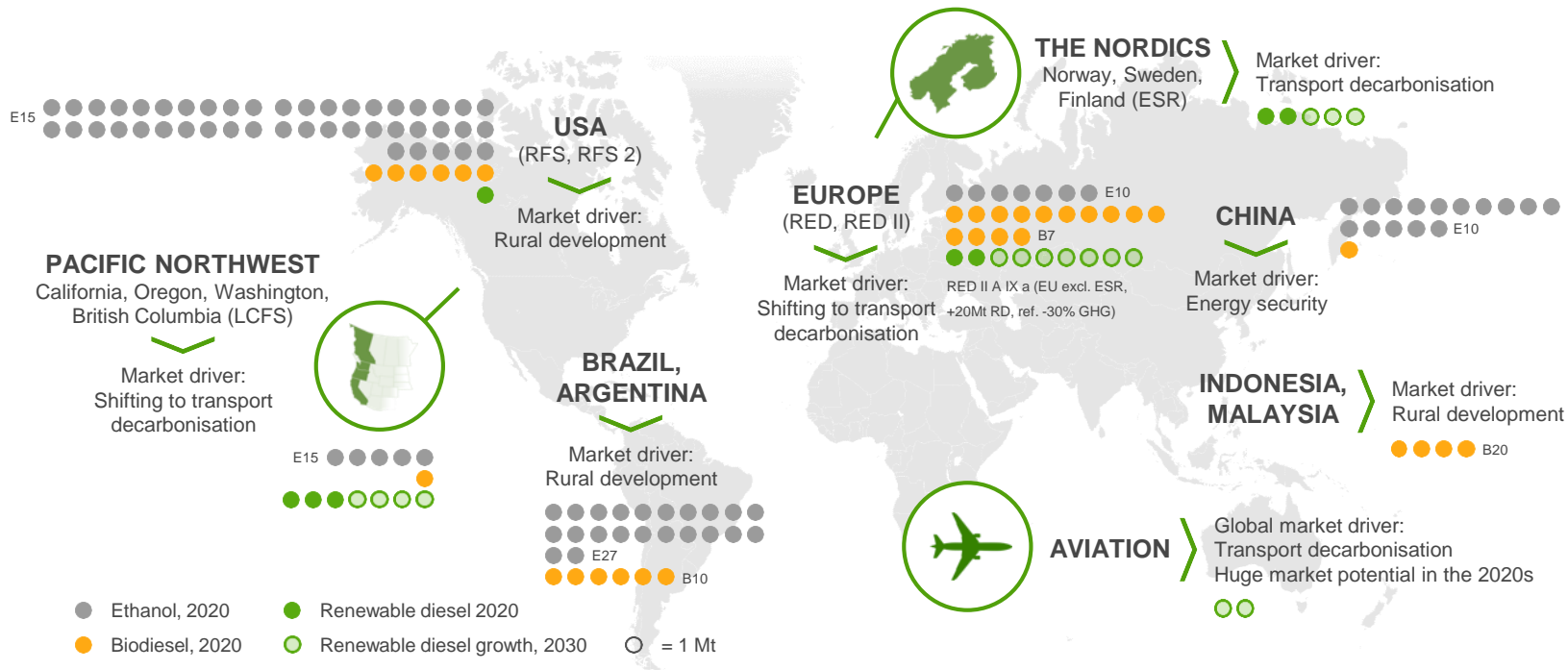


GHG-reduction targets calculated vs. reference year 2005 (2020 -6% FQD, 2030 -30% ESR, 2040 -50% proj.)

Source: UPM analysis based on Bloomberg and WoodMackenzie

# UPM Biofuels

## Strong renewable diesel demand growth, as markets evolve from rural development to decarbonisation



Source: UPM



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## UPM Biofuels

# UPM Biofuels business entry has been successful – now exploring next steps for scaling up

UPM announces its plans to become a **significant producer of advanced biofuels**

**2006**



**2008**

**Hydrotreatment** process development starts in UPM Research Centre



**2012**

**First investment decision (179 M€) UPM Lappeenranta Biorefinery**  
Renewable diesel made from crude tall oil



**2015**

UPM Lappeenranta Biorefinery starts commercial production  
**Sales of UPM BioVerno launched in Finland**



**2016**

**UPM Biofuels Development** programme established  
Sales of UPM BioVerno expands to Nordic countries

**Business case successful**  
Profitability reaches UPM average

**2017**

**Feasibility study**  
UPM starts an EIA-study of a possible Kotka Biorefinery

**2018**



**2019 →**

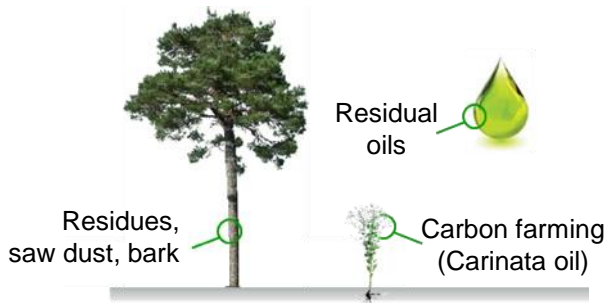
Preparation continues for a possible investment decision of the Kotka Biorefinery



## UPM Biofuels

# The possible Kotka Biorefinery: an innovative and robust concept to scale up the business

- ✓ Competitive and sustainable feedstocks



UPM feedstocks



Lappeenranta Biorefinery  
100kt



Potential Kotka Biorefinery  
500kt

- ✓ Low-carbon fuels for road, aviation, shipping and petrochemicals



UPM renewable fuels

- ✓ World-scale biorefinery leveraging UPM ecosystem
- ✓ Significant efficiency gains enabled by economy of scale and synergies with Lappeenranta



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# UPM Biochemicals



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UPM Biochemicals

# Megatrends convert to strong end-use development

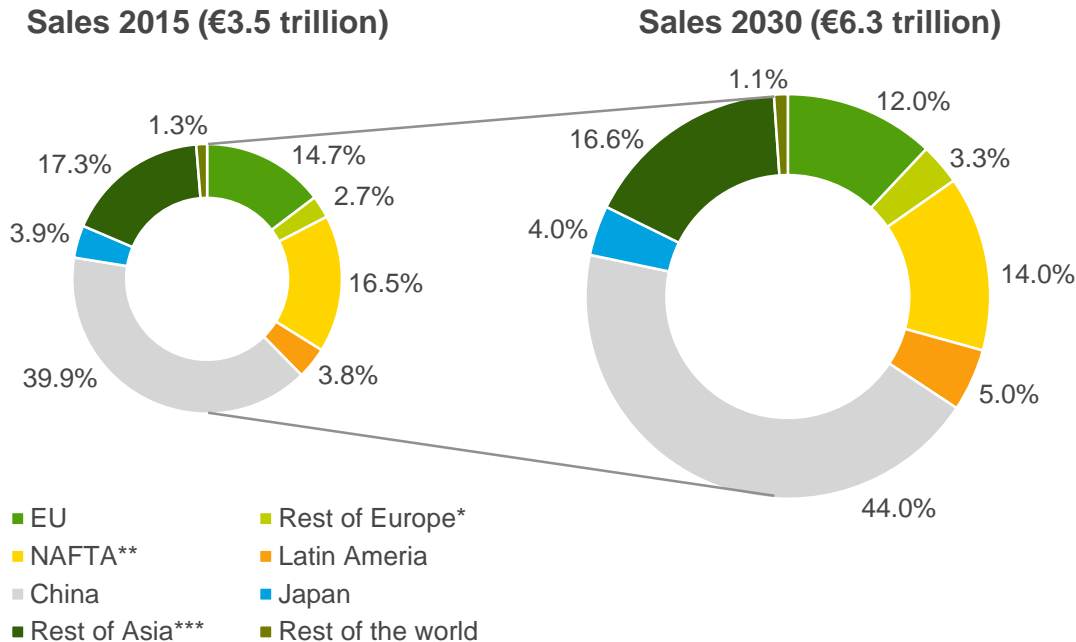
<p>Paints, furniture, cosmetics, electronics, aviation...</p>					
<p>Toys, food packaging, transportation, hygiene, office supplies...</p>					
<p>Construction, textiles, pharma, industrial, detergents...</p>					

physical goods are made from and/or with chemicals

# ...and as a result robust growth in the chemicals markets



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**Demand for sustainable solutions will drive the growth of bio-based chemicals faster than overall market**

Source: Cefic Chemdata International 2016  
 \* Rest of Europe covers Switzerland, Norway, Turkey, Russia and Ukraine  
 \*\* North American Free Trade Agreement  
 \*\*\* Asia excluding China, India, Japan and South Korea

Unless specified chemical industry excludes pharmaceuticals  
 Unless specified EU refers to EU 28

UPM Biochemicals

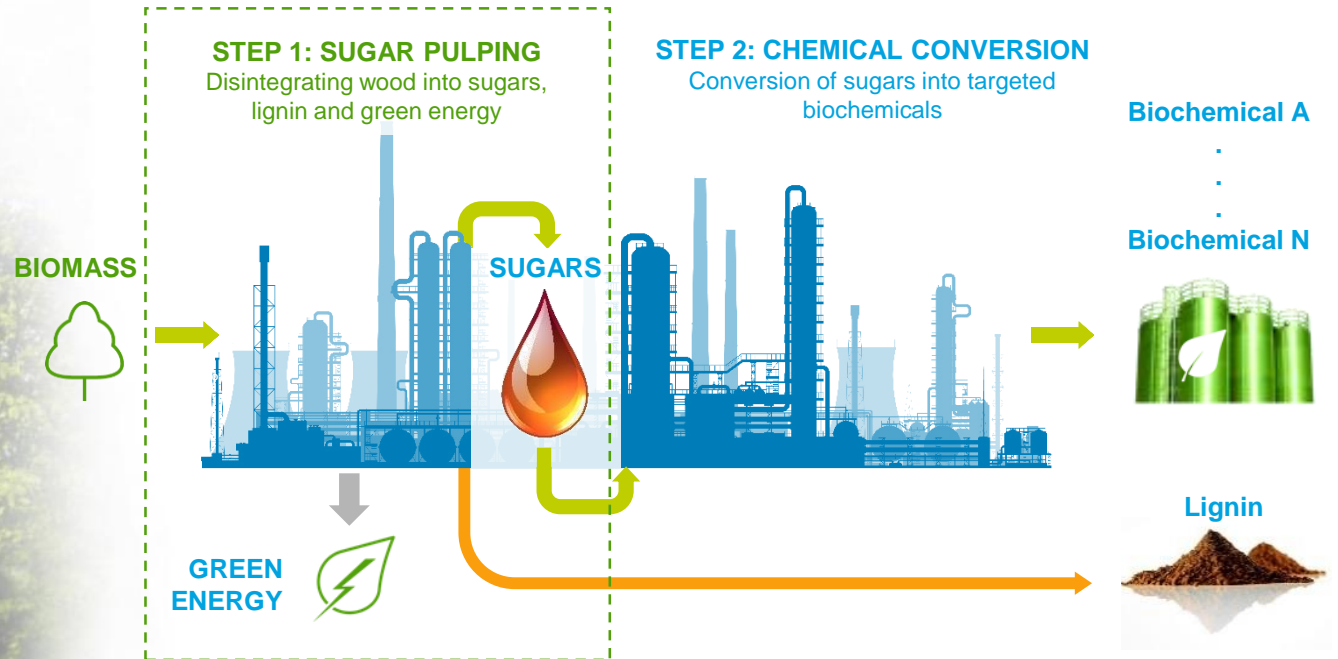
# Biochemicals products are sustainable and competitive alternatives to replace fossil materials



## BIOREFINERY PROCESS

FIXED TECHNOLOGY PLATFORM

VARIABLE FOR EACH BIOREFINERY





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# Biochemicals development towards industrial scale operations

Creation of  
biochemicals **vision**  
and **strategy**

**2011**



**2012–15**

Broad evaluation  
of various **sites**,  
**technologies** and  
**chemicals**



**2015–16**

Commercial  
assessments  
of **different**  
**chemicals** and  
**markets**



**2015–16**

Feasibility  
engineering  
studies for  
**short-listed**  
**concepts**

**Basic engineering**  
for the potential  
first biorefinery,  
commercial  
projects

**2017–18**



Preparation  
continues, possible  
implementation  
of the first biorefinery

**2019–**



Biochemicals

# Biochemicals biorefinery targeting to produce bio-MEG, bio-MPG and lignin from hardwood



Monoethylene glycol

- Existing fossil-based market
- Market demand > 26 m tonnes
- CAGR > 3%
- Application examples:



Textiles



Bottles & packaging



Deicing fluids



Monopropylene glycol

- Existing fossil-based market
- Market demand > 2 m tonnes
- CAGR > 5%
- Application examples:



Composites



Pharma & cosmetics



Detergents



Biorefinery lignin

- Performance chemical
- Application driven
- Strong IP position
- Application examples:



Wood resins



Plastics



Foams & coatings



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# Summary



# Molecular bioproducts businesses – replacing fossil materials

## UPM BIOFUELS

### Decarbonising traffic

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Renewable fuels are the fast track to reduce transport emissions

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Large and growing markets

Emission reduction targets and mandates drive the demand

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UPM's advantages:

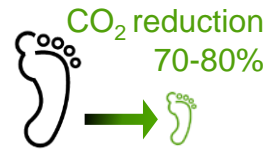
- Sustainable feedstocks
- Biorefinery technologies and IPR

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Commercial market entry successful

Exploring next steps to scale up

Scale up is possible by 2022\*



## UPM BIOCHEMICALS

### Sustainable solutions for consumers

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Chemicals markets today are based on fossil raw materials (oil/gas/coal)

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Large and growing markets

Strong market pull for sustainable alternatives

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UPM's advantages:

- Sustainable feedstocks
- Biomass processing technologies and IPR

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Basic engineering under way for the possible first biorefinery

Commercial market entry is possible by 2021\*



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