BIOFIT

Bioenergy Retrofits for Europe's Industry

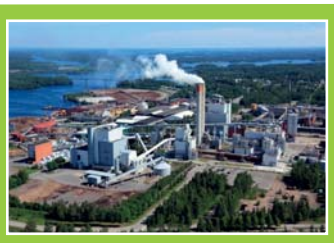
HORIZON 2020
BIOFIT PROJECT

BEST PRACTICE
FACTSHEET

RETROFIT OF UPM PULP AND PAPER MILL (FINLAND)

KEY INFORMATION

Plant owner:	UPM
Plant name:	UPM Kaukas - Lappeenranta integrated mill
Location:	Lappeenranta, Finland
Industry sector:	Pulp
Main product of plant:	Pulp and paper
Retrofit measure:	Construction of new biofuel plant which uses pulp residues
Beginning of retrofit:	2012
Start-up after retrofit:	2015
Capital Expenditure:	179 Million EUR



Copyright of photos: UPM

TECHNICAL DATA

	INITIAL STATE	AFTER RETROFIT
Capacity of main product (pulp) [t/y]	**Not available**	**770,000**
Amount of biofuel produced [t/y]	**-**	**100,000**
Estimated annual GHG emissions from entire facility [tCO_2eq]	**Not available**	**102,199 ***
Estimated annual specific GHG emissions [$tCO_2eq/(t_{main\ product})$]	**Not available**	**Not available**

*Source: EMAS report of UPM, 2017. The facility consist of paper mill, pulp mill, sawmill, biorefinery and CHP boiler

INITIAL STATE

Industrial activities at the site in Lappeenranta started in 1892, with the establishment of a spool factory. Pulp production at Kaukas began five years after the spool factory had been established. The first sawmill was established on the site in 1898, and a modern paper machine started production in 1975. Today the pulp mill produces 770,000 tonnes of softwood and birch pulp annually, whereas the main products of the paper mill are coated magazine papers (actual production 305,000 tonnes/y). The sawmill has an output of 510,000 m^3/y of sawn timber.

"UPM's Lappeenranta Biorefinery is the first commercial-scale biorefinery to produce renewable wood-based diesel and naphtha. The biorefinery is right next door to the UPM pulp and paper mill."

RETROFIT

MOTIVATION AND DECISION

In 2008, with the decline of graphic paper usage, UPM started to explore for new businesses. At that time biofuels were a prevalent trend and UPM had suitable wood-based residues available from own pulp production as feedstock. In 2012, it was decided to extend the industrial site by building a new biorefinery that uses the wood-based residues of the pulp mill. This is the world's first biorefinery producing wood-based renewable diesel.

PLANNING AND EXECUTION

After the investment decision, the construction of the biorefinery started during the summer of 2012. UPM's total investment cost were about EUR 179 million and were covered without any public investment grants. NIB co-financed the project with a 7-year maturity loan of EUR 50 million. The biofuels production process has been developed in the UPM Biorefinery Research and Development Centre in Lappeenranta. The biorefinery started commercial production in January 2015.

1892 START OF THE SPOOL FACTORY

2008 IDEA OF RETROFITTING PLANT

2012 DECISION ON RETROFIT. START OF BIOREFINERY CONSTRUCTION

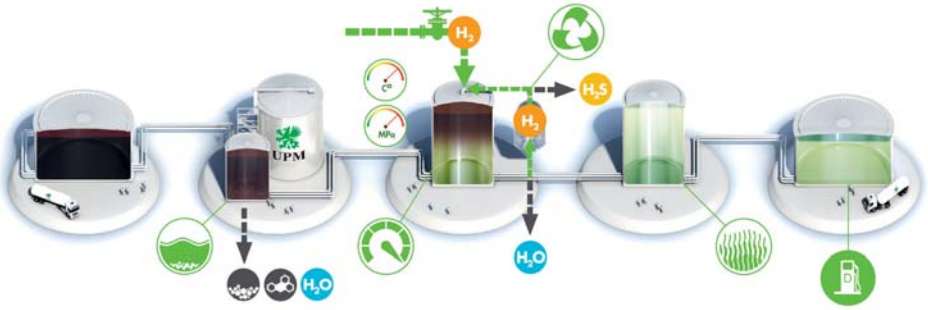
2015 NEW BIOREFINERY STARTS OPERATION

CURRENT STATE

At present, the annual production of the biorefinery consist of 100,000 tonnes of renewable diesel and renewable naphta. The production of renewable fuels from wood-based tall oil is based on hydrotreatment. The phases of the process are pretreatment of crude tall oil, hydrotreatment, separation of hydrocarbons, recycle gas purification, and fractionation to produce renewable diesel and a small portion of renewable naphtha as end products.

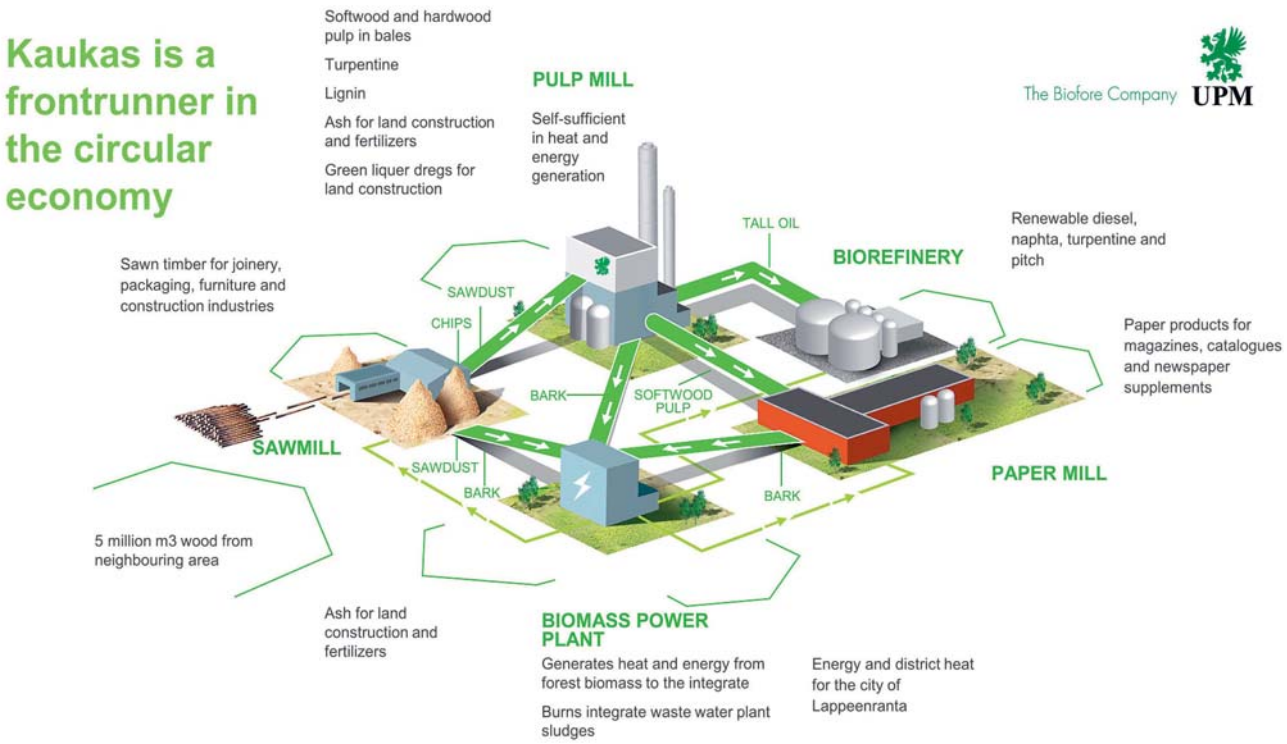
- Pretreatment: Crude tall oil is purified; salts, impurities, solid particles and water are removed.
- Hydrotreatment: Pretreated crude tall oil is fed together with make-up and recycled hydrogen to the reactor where the chemical structure is modified. Reaction water is separated and directed to waste water treatment.
- Fractionation: Remaining hydrogen sulfide and uncondensable gases are removed. The remaining liquid is distilled to separate renewable diesel. The final product (UPM BioVerno diesel) can be used as a blending component or as 100% fuel in all diesel engines and fuel distribution systems

A significant portion of the raw material used at the UPM Lappeenranta Biorefinery - crude tall oil - comes from UPM‘s own pulp mills in Finland, such as the UPM Kaukas mill site located next door.



CRUDE TALL OIL	PRETREATMENT	HYDROTREATMENT	FRACTIONATION	RENEWABLE DIESEL
A residue of chemical pulping process containing natural extractive components of wood.	Crude Tall Oil is purified: salts, impurities, solid particles and water are removed.	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.	Remaining hydrogen sulfide and uncondensable gases are removed. The remaining liquid is distilled to separate renewable diesel.	High quality advanced biofuel suitable for all diesel engines. RENEWABLE NAPHTHA Advanced renewable biocomponent for gasoline or raw material for bioplastics.

Figures:
courtesy of UPM



IMPACT

UPM BioVerno diesel reduces GHG emissions by 80% compared to fossil diesel. Thanks to the development of UPM BioVerno diesel, UPM plans to become a major player in Europe in the production of renewable, high quality advanced biofuels.

"Wood and its efficient use are the core of UPM operations. We turn all side streams and residues into raw materials for new products. We reuse materials traditionally considered as waste several times and create added value through smart solutions."

SOURCES

https://www.upmpulp.com/about-upm-pulp/pulp-mills/kaukas/

https://www.upmpaper.com/about-upm-paper/our-paper-mills/upm-kaukas-paper-mill/

http://www.etipbioenergy.eu/images/Factsheet_UPM_final.pdf

EMAS report of UPM, 2017 of UPM, 2017
https://www.upm.com/siteassets/documents/responsibility/1-fundamentals/emas-reports/upm-pulp-and-paper-mills-report/english/kaukas_emas_2017_en.pdf

MORE INFORMATION ABOUT THE UPM PLANT

Website www.upmbiofuels.com Contact biofuels@upm.com

UPM

THE BIOFIT PROJECT

BIOFIT
Bioenergy Retrofits for Europe's Industry

This best practice factsheet was prepared within the BioFIT project.
The project aims to facilitate the introduction of bioenergy retrofitting in Europe's industry.
Target industries are

- First-generation biofuels
- Pulp and paper
- Fossil refineries
- Fossil firing power
- Combined Heat and Power (CHP)

Success factors of the best practice case studies are used as basis to develop **10 concrete bioenergy retrofitting proposals** (2 per industry sector) and to facilitate the two-way dialogue with industry in dedicated working groups. The overall target is to integrate bioenergy and biofuels in existing industrial installations and encourage others to follow the existing examples.

Project website https://www.biofit-h2020.eu Contact reumerman@btgworld.com

Project coordinator: BTG Biomass Technology Group Author of this factsheet: Bioenergy 2020+ GmbH

Disclaimer: The sole responsibility for the content of this factsheet lies with the authors. It does not necessarily reflect the opinion of the European Union. Neither the INEA nor the European Commission are responsible for any use that may be made of the information contained therein. This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 817999