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

TECHNICAL DATA

- Capacity of main product (pulp) [t/y]: Not available
- Amount of biofuel produced [t/y]: Not available
- Estimated annual GHG emissions from entire facility [tCO₂eq]: Not available
- Estimated annual specific GHG emissions [tCO₂eq/(t of main product)]: Not available

INITIAL STATE

- Not available

AFTER RETROFIT

- 770,000
- 100,000
- 102,199 *

*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 m³/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.
CURRENT STATE

At present, the annual production of the biorefinery consist of 100,000 tonnes of renewable diesel and renewable naphtha. 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.

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Kaukas is a frontrunner in the circular economy

- Softwood and hardwood pulp in bales
- Turpentine
- Lignin
- Ash for land construction and fertilizers
- Green liquor drugs for land construction

**PULP MILL**

- Self-sufficient in heat and energy generation

**SAWMILL**

- 5 million m³ wood from neighbouring area
- Ash for land construction and fertilizers

**BIOMASS POWER PLANT**

- Generates heat and energy from forest biomass to the integrate
- Burns integrate waste water plant sludges

**BIOREFINERY**

- Renewable diesel, naphtha, turpentine and pitch

**PAPER MILL**

- Paper products for magazines, catalogues and newspaper supplements

**UPM**

The Biofore Company

- Renewable diesel, naphtha, turpentine and pitch
- Paper products for magazines, catalogues and newspaper supplements
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/
EMAS report of UPM, 2017 of UPM, 2017

MORE INFORMATION ABOUT THE UPM PLANT
Website www.upmbiofuels.com Contact biofuels@upm.com

THE BIOFIT PROJECT

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
• Fossil firing power
• Pulp and paper
• Combined Heat and Power (CHP)
• Fossil refineries

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.

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