

RETROFIT OF METSÄ FIBRE JOUTSENO PULP MILL (FINLAND)

BEST PRACTICE FACT SHEET

KEY INFORMATION

Plant owner:	Metsä Fibre Oy
Plant name:	Joutseno pulp mill
Location:	Joutseno, Finland
Industry sector:	Pulp and paper
Main product of plant:	ECF bleached softwood pulp
Retrofit measure:	Construction of new gasifier plant, which supplies biomass-derived gas to fuel the lime kiln
Beginning of retrofit:	2011
Start-up after retrofit:	2013
Capital Expenditure:	20 Million EUR



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TECHNICAL DATA

Capacity of main product (pulp) [t/y]
Main fuel for lime kiln
Annual GHG emissions from entire facility [tCO ₂ eq]
Annual GHG emission from fossil sources [[tCO ₂ eq]
Calculated annual specific GHG emissions from fossil sources [kgCO ₂ eq/t _{main product}]

INITIAL STATE

690,000
Natural gas
1445,000*
79,000*
131***

AFTER RETROFIT

690,000
Gasified bark
1427,000**
17,000**
26***

* Source: Metsä Fibre environmental declaration of 2011

** Source: Metsä Fibre environmental declaration of 2017

*** Calculated as the ratio of the GHG emissions from fossil sources of the entire facility and the actual pulp production in 2011 (603,035 tonnes, according to environmental declaration) and in 2017 (655,425 tonnes - environmental declaration)

INITIAL STATE

The Metsä Fibre pulp mill in Joutseno can be traced back to 1909. The mill was completely modernized at the turn of the 21st century. Annually, the mill produces up to 690,000 tonnes of ECF bleached softwood pulp. The mill uses the heat and electricity produced during the pulp manufacturing process and natural gas was used to fuel the lime kiln.

“The technology in the gasification plant was a new application in the Finnish pulp industry. The gasification plant made the pulp mill the first carbon dioxide-neutral facility in Finland.”

RETROFIT

MOTIVATION AND DECISION

The motivation for the retrofit was both environmental and economic. Metsä wanted to replace the natural gas supply to the lime kiln (having a capacity of 600 tonnes per day) with a low-cost renewable fuel. The availability of bark at the mill was the driver for selecting the gasification technology. Before the retrofit, the bark (a combination of pine, spruce and birch) was sold to a local CHP plant. Another motivation for the retrofit was that Metsä aims to make all its mills CO₂-neutral.

PLANNING AND EXECUTION

The contract for the retrofit project was awarded to Andritz Oy, the Finnish subsidiary of the Austrian company, which proposed a complete 48 MWth gasification plant. The gasification plant is based on the Circulating Fluidized Bed technology developed by Andritz. This is a state-of-the-art technology typically used for gasification of forest feedstocks such as bark. The scope of the delivery included the biomass feedstock handling systems, belt dryer, feeding conveyor to the gasifier, ash handling, gasifier, auxiliary systems and a replacement burner for the lime kiln. The work started in 2011 and was completed in March 2013. The mill already used other equipment from Andritz and had an on-going service contract. The cost of the retrofit was approximately 20 million EUR. The Ministry of Economic Affairs and Employment of Finland allocated 4 200 000 € Energy Aid for the investment.

1909

START OF
PULP MILL

1998

NEW
RECOVERY
LINE

2001

NEW
FIBRE
LINE

2006

PERMISSION
PROCEDURE FOR
GASIFICATION
PLANT BEGINS

2011

START OF
GASIFIER
CONSTRUCTION

2013

NEW GASIFIER
STARTS
OPERATION

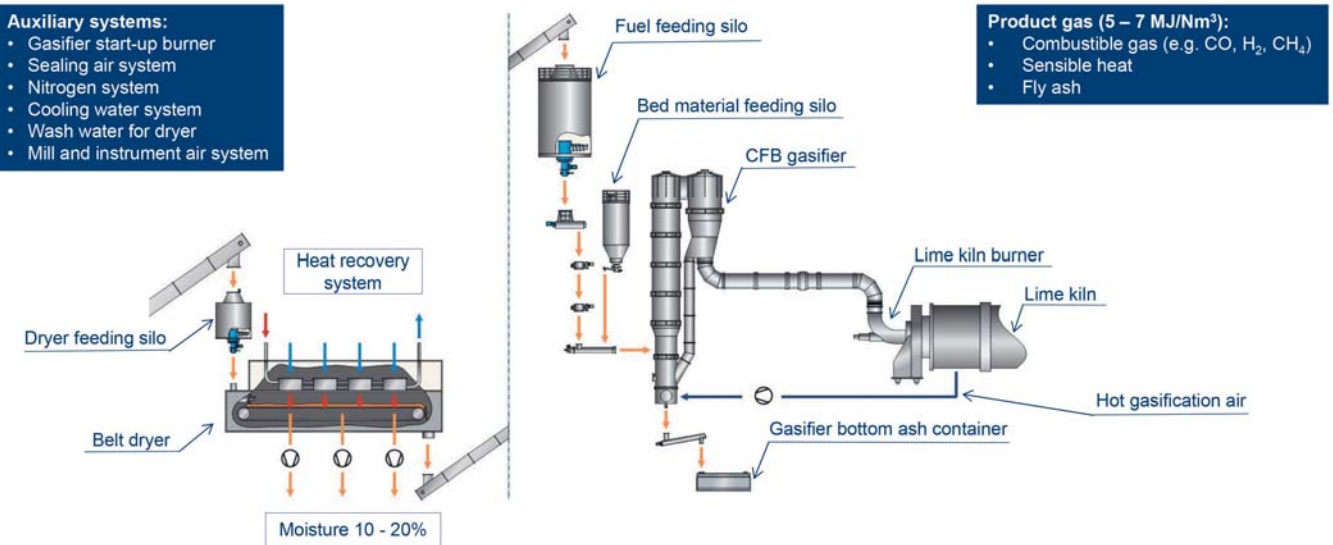
CURRENT STATE

In the Joutseno mill, surplus heat from the mill is used to dry the tree bark which is then fed into the gasifier. For the drying process, the feeding system conveys roughly 22 tonnes per hour of wet bark to the belt dryer distributing it evenly across the 8 m wide belt. Using the residual hot water and low-pressure steam from the mill, the air in the dryer is heated indirectly via heat exchangers to about 95°C. The dryer has an evaporation capacity of up to 12 tonnes per hour and the bark leaving the dryer has a moisture content of 4%.

The dried feedstock fed to the gasifier is approximately 11 tonnes per hour. The gasifier operates at about 750-800°C. The turbulent mixing in the fluidized bed compensates for fuel quality fluctuations, accommodating low-grade fuels with variable moisture and ash content. The management of nitrous oxides (NOx) and sulphur oxides (SOx) is accomplished without post-combustion cleaning equipment.

The gas produced by the new gasification plant has replaced the natural gas used in the lime kiln, whose burner has been replaced by a new multi-fuel burner. Since it started operation, the gasifier itself has been performing as expected.

SIMPLIFIED FLOW SHEET



1 / PULP & PAPER / RECOVERY AND POWER CAPABILITIES / COPYRIGHT © 2018

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IMPACT

The Joutseno mill has now replaced 95% of natural gas used in the lime kiln with biomass derived gas. Hence the retrofit has considerably improved the mill's environmental performance. Annual CO₂ emissions from fossil sources are reduced by approximately 70.000 tonnes. Overall, Metsä Fibre has realised a short pay-back time on the investment.

“Natural gas was replaced with green energy from a very low-cost fuel source. A key goal for Metsä Fibre is to make all the mills carbon dioxide-neutral in the coming years.”

SOURCES

<https://technology.risiinfo.com/mills/west-europe/mets-fibre-launch-48-mw-gasification-plant-its-joutseno-mill-finland-autumn>

<https://globenewswire.com/news-release/2013/03/07/528820/0/en/Mets%C3%A4-Group-s-Joutseno-pulp-mill-s-gasification-plant-inaugurated.html>

<https://bioenergyinternational.com/heat-power/worlds-largest-single-line-pulp-mill-carbon-neutral>

<https://yle.fi/uutiset/3-5320418> (in Finnish),

MORE INFORMATION ABOUT THE METSÄ FIBRE PULP MILL

Website www.metsafibre.com Contact www.metsafibre.com/en/contact/



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.

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

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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

