

Climate change and sustainable development lead pulp and paper industry towards new possibilities

BIOFIT Final Policy Conference

19 January 2022, online

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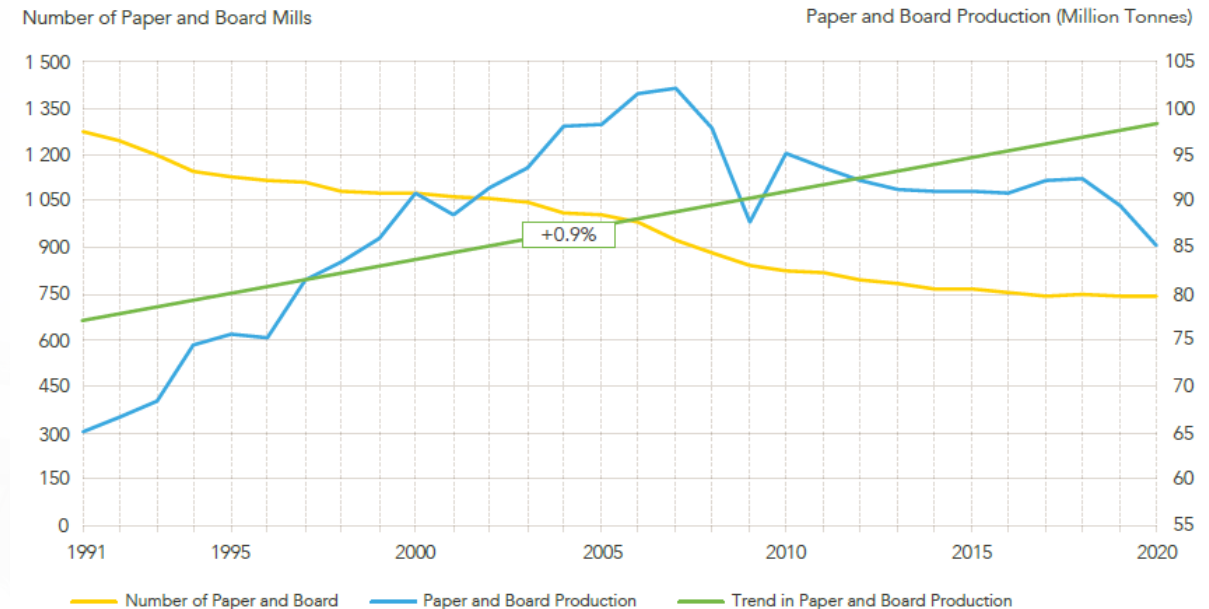
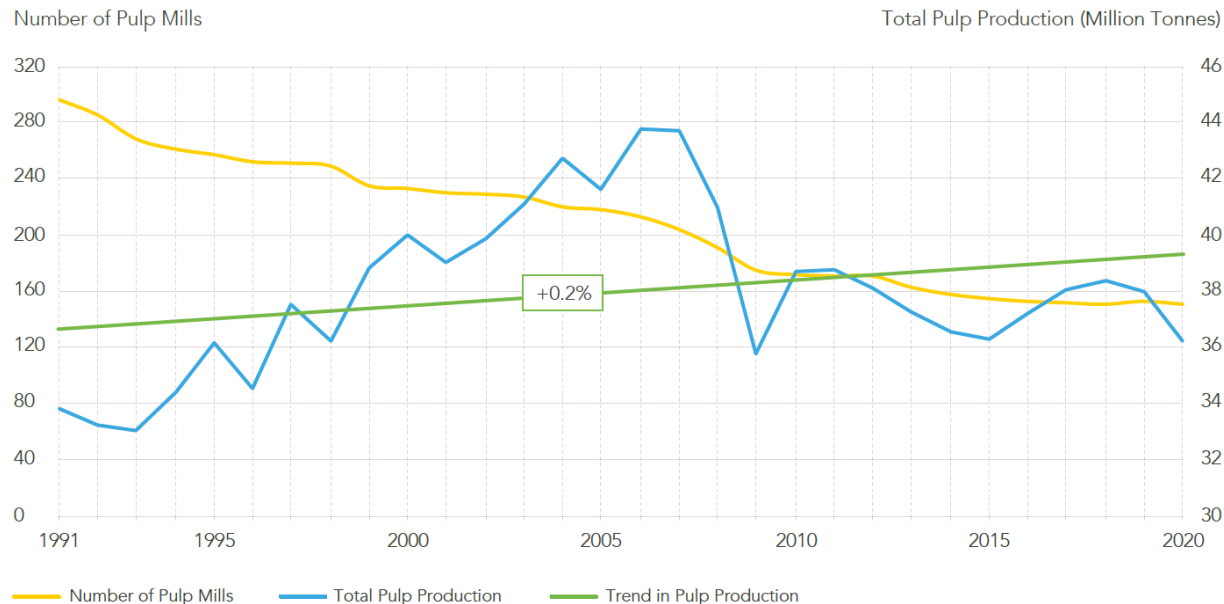
This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 817999.



P&P Sector Status-Quo

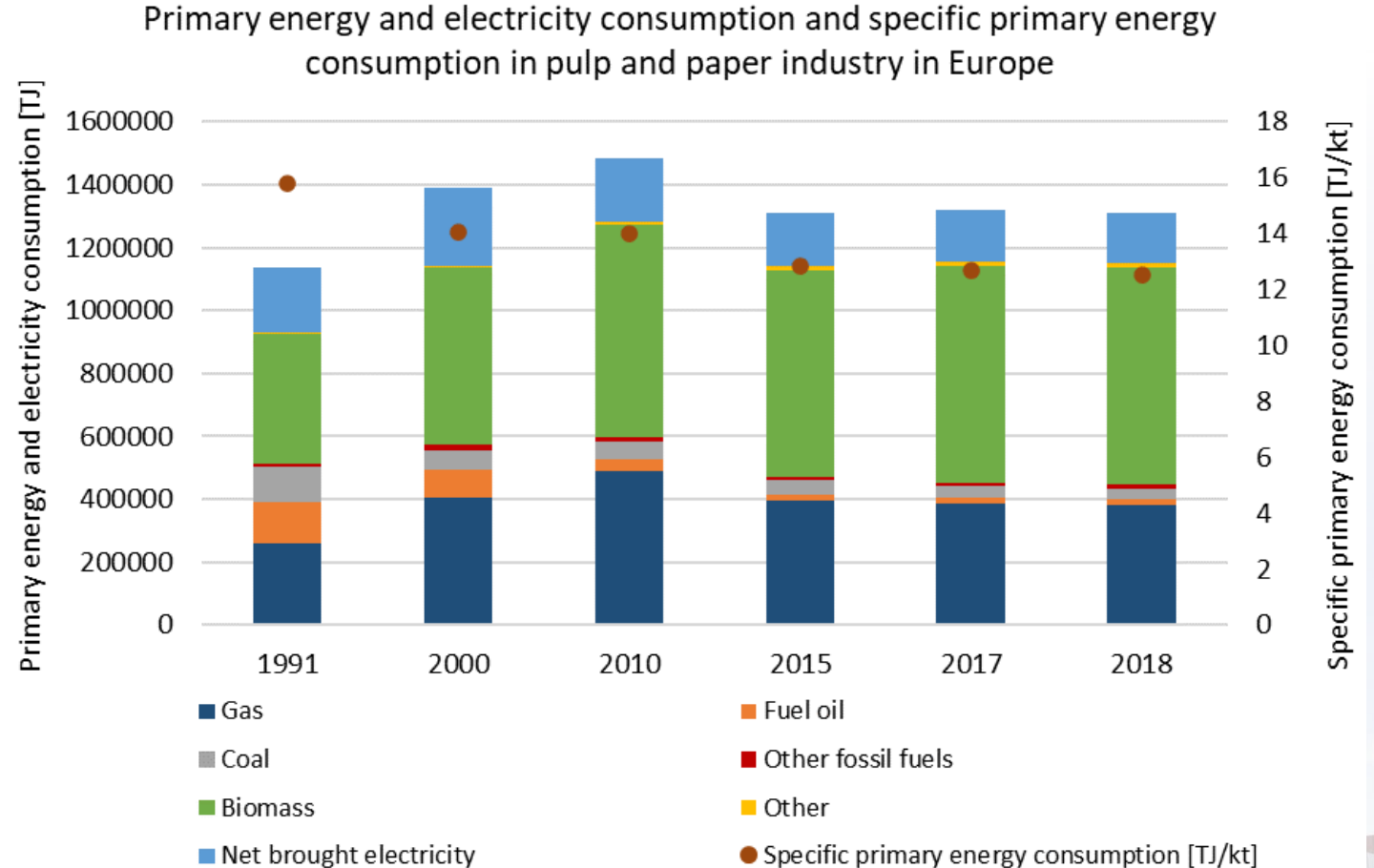
- In Europe, there exist 151 pulp mills and 743 paper and board mills, which produce annually 36 million tons of pulp and 85 million tons of paper and board (2020)
- The number of the mills has steadily decreased since 1990's, while the total pulp production has stayed relatively stable.
- In addition to traditional products, the industry has shown ample interest in **widening their product portfolios** by developing and producing **new high-value products**, such as biofuels, bio-composites and bio-based plastics, and in **revising their business models**.

Source: CEPI. Cepi Key Statistics 2020 – European pulp & paper industry



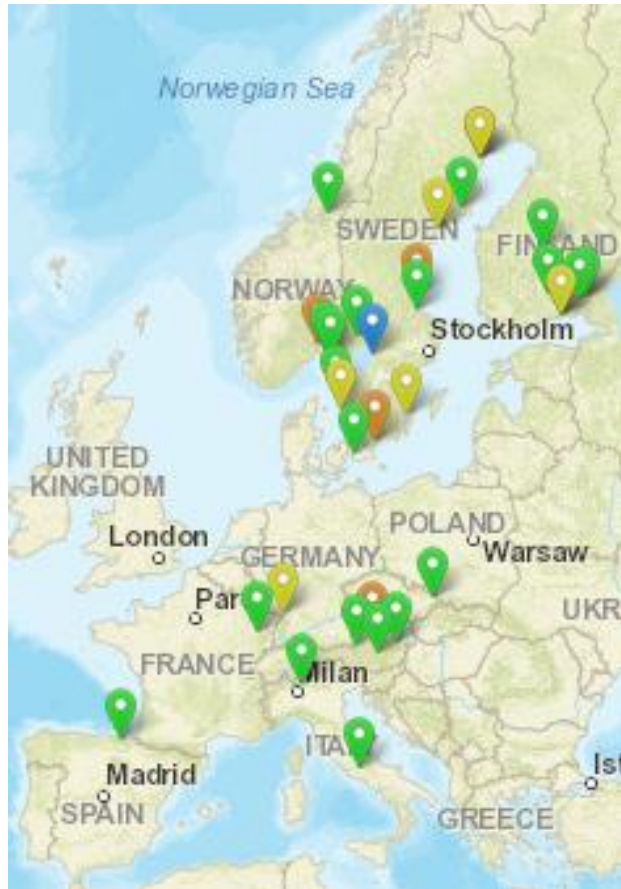
Fuel and energy consumption

- The P&P industry in Europe already covers 60.0% of their total fuel consumption and 52.5% of their total primary energy consumption by biomass
- Energy efficiency measures have steadily decreased the specific primary energy consumption within the sector
- The share of biomass used for energy has increased over the years.
- Fossil fuels represent 38.9% of the total fuel consumption (2018).



Source: Modified from Cepi Key Statistics 2019

Retrofits in European P&P sector



Bioenergy retrofits relate to both substitution of fossil fuels at sites and production of new renewable products, mainly fuels for the transport sector.

Side streams:

Bark
Sawdust sludge
Black/Brown liquor
Foul condensates of black liquor
"Soap"
Hemicellulose
Lignin
Sludge/slurry



Retrofits:

Biomass CHP integration
Biomass or biomethane use in lime kiln
[Bark gasification](#)
[Brown liquor ethanol](#)
[Tall oil biodiesel](#)
Hydrothermal liquefaction of lignin
Anaerobic digestion of sludge
[Valorisation of pulp and paper slurry](#)
Black liquor gasification to DME
Lignin extraction from black liquor
Methanol from pulp mills



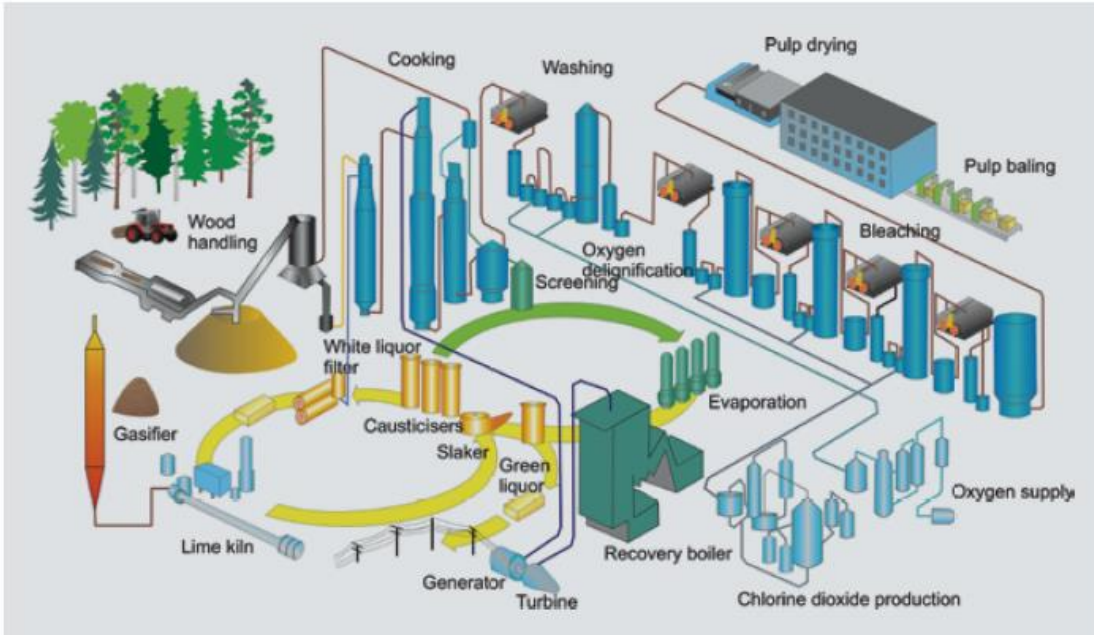
Products:

Heat
Electricity
Biogas
Biomethane
Biodiesel
Ethanol
Biocrude
Biomethanol
DME
Lignin
Biochar/HTC biocoal

Currently known P&P retrofits (Figure source:
<https://www.biofit-h2020.eu/biofit-industry-map/>)

More information from: [BIOFIT Handbook](#), [BIOFIT Best Practice Factsheets for P&P sector](#)

Drivers to bioenergy retrofitting



A schematic diagram of a typical energy self-sufficient Nordic Pulp Mill
(Source: IRENA (2018), Bioenergy from Finnish forests: Sustainable, efficient and modern use of wood, International Renewable Energy Agency, Abu Dhabi.)

• Digitalization

- Bioenergy retrofits provide valuable bio-based products for the energy and transport sectors and allow the P&P companies to widen their product portfolios and to create new businesses.

• Climate change mitigation

- Urgent need for climate change mitigation increases the demand for energy, fuels and products from renewable sources. Bioenergy retrofits support the achievement of the European climate and energy targets.

• Circular economy and sustainability

- The role of forests as carbon sinks is getting more important and may limit the direct use of virgin wood. Bioenergy retrofits enable more efficient use of side streams.

• Energy and material efficiency

- Pulp mills that are no longer integrated to paper mills use less energy than before, which opens up opportunities for producing high-value bioenergy products from their side streams.

Prerequisites for retrofitting

- Bioenergy retrofit technologies are **not directly replicable** from one mill to another:
 - suitability depends on the used pulping technology, local operational environment and markets
 - The volume of available the residues limits potential amount of final products
 - feasibility of retrofits must be assessed case by case
- **process during the first retrofit establishment can lead to further retrofitting**
 - knowledge gained from the first retrofit implementations are valuable.
- **Availability of local networks is in essential role** when retrofits are considered
 - value chain needs to be built up from the production to customers
 - some of the products need further refining before entering the markets



Domsjö Fabriker's (Sweden) main products are cellulose, lignin and bioethanol. Bioethanol is sold to SEKAB for further refining or resale. (Figure source: Domsjö Fabriker)

Reference: [Drivers and barriers in retrofitting pulp and paper industry with bioenergy for more efficient production of liquid, solid and gaseous biofuels: A review](#)

Challenges to bioenergy retrofitting



Demonstration in the EffiSludge for LIFE project aimed at improving the energy efficiency of the aerobic wastewater treatment processing wastewaters from the pulp mill at the site of Norske Skog's pulp mill. Source of Figure: <https://scandinavianbiogas.com/en/project/skogn-en/>

- **Feedstock availability and acceptability**
 - Tightening sustainability criteria and concerns related to carbon sinks and biodiversity create uncertainty.
 - The mills are in different positions regarding availability of biomass
- The retrofit options have **different technical readiness levels**
 - commercial vs. only in demonstration or pilot face
 - challenges in assessing the feasibility of emerging technologies
 - emerging technologies require R&D funding and investment support
- **Rapidly changing policy and market conditions**
- **International competition**

More information from: [Drivers and barriers in retrofitting pulp and paper industry with bioenergy for more efficient production of liquid, solid and gaseous biofuels: A review](#)

- **R&D funding as well as investment support should be targeted to new technologies that allow efficient side-stream utilisation and increase overall energy-efficiency.**
- Long-term political support and consistency in the development of the regulatory framework would be important to **support the investments and the scaling-up of the retrofit technologies** that typically require high upfront investments.
- **Research and funding should be allocated for studying the possibilities for broadening their feedstock base and increasing awareness of related challenges.** Potential means could include support for finding alternative feedstocks, investments in energy efficiency and other new technological solutions that could help in decarbonisation of the sector.
- While **tackling** the greenhouse gas emissions at the EU-level, most industries are exposed to **international competition**. According to The European Green Deal [17], “The commission will propose a carbon border adjust mechanism, for selected sectors, to reduce the risk of carbon leakage.” This is of importance to the pulp and paper industry sector, for example, to avoid problems with intercontinental competition.



Södra Cell Bioproducts' biomethanol plant at Södra's mill in Mönsterås is one of a kind bioenergy retrofit in pulping industry. Source of figure: Södra's image bank/Södra Skogsägarna

More information from: [Sectoral Recommendation Paper: Pulp and paper](#)

Digital support tools



- The interactive Digital Support Tools (DSTs) are designed for industries to determine **the benefits of bioenergy retrofitting**.
- The DSTs are **based on the BIOFIT case studies**, and they represent each industrial sector involved in the project (production of 1st generation biofuels, pulp & paper, fossil power and CHP and for fossil refineries).
- The DSTs focus on **the techno-economic evaluation of the retrofit concepts**, allowing to assess the net present value, internal rate of return and cash flows of the retrofit investments. Additionally, the **impacts to greenhouse gas emissions** are shown.
- The user interface allows **modification of the key parameters of the retrofit concept**.

Thank you!

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