

## **Transformation of Forest Industry Energy Production and Use, How Will it Look in 2050?**

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Modern kraft pulp mills are still going strong. The key to success is the ability to constantly improve and adapt to needed changes. On the other hand, a new era of biorefinery focused production and CO<sub>2</sub> utilization is emerging. It has been realized that in addition to pulp there are various possibilities to produce additional value.

Newest kraft pulp mills are more than self-sufficient in energy; additional electricity production becomes the means of additional profit generation for the mill by selling the surplus. The modern recovery boiler produces more electricity without biomass boiler than the pulp mill requires. The added value produced by forests can be increased without increasing the amount of felling and outlines the structural changes this requires. This requires that we produce more different and further processed products from wood than at present. Several solutions are needed to increase the value added.

As one reduces the PPI CO<sub>2</sub> emissions, it must be decided how the valuable biomass should be utilized in the future. In the near future, the bio-based waste streams should be utilized better together with the energy efficiency improvement and electrification of processes and energy production. In the long-term future, the new products from the PPI industry may play a key role in the bioeconomy that aims to eliminate fossil raw materials. The technologies for the production of these renewable products are mostly available, but currently the projects do not get implemented because the continuously changing business environment is not attractive for investors and low prices for fossil alternatives are hindering the development. To advance, the role of bioeconomy and e-fuels in the sustainable transition needs to be clarified, and the role of the PPI should not be underestimated, as there will be a huge need for renewable and sustainable materials.

Biogenic CO<sub>2</sub> production in the Nordics is more than 50 MtCO<sub>2</sub>/a. If 10 MtCO<sub>2</sub>/a is produced to e-methanol, this will require 9000 MW of additional electricity, which is about the same as Finnish consumption. Production of 7.5 MtMeOH has the value of about 8 000 M€ depending on the green methanol price premium. If the same 10 MtCO<sub>2</sub>/a is used as BECCS i.e. captured, transported and stored at the bottom of North Sea, then the value is about 1 000 M€ assuming about 100 €/tMeOH. If we use the same amount of electricity to produce just hydrogen, then production is about 1.5 MtH<sub>2</sub> with value of about 2 000 M€. Hydrogen price has correlated strongly with natural gas price.

As P&P industry heads into 2050 there has emerged several profitable additional products that could produce added value. Producing maximum amount of electricity might not be the way to go. Instead, the electricity could be used to produce more added value like efuels or power the electrification of the pulp mill.

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