



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

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Content

- What has happened
- Where are we going
- Ongoing trends
- Forest industry 2050



Kraft pulping will continue

- Modern kraft pulp is still going strong and there seems no end to the dominance.
- 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 is emerging.



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Few words on past

WHAT HAS HAPPENED

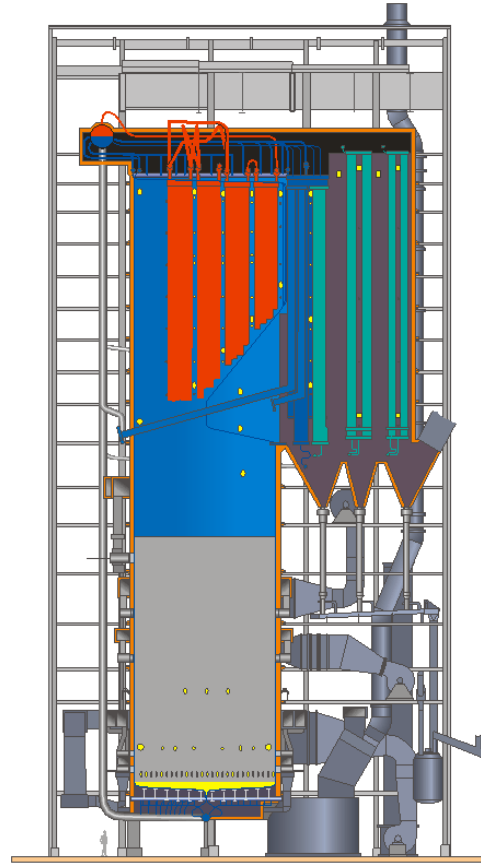


Fossil free energy production

- Modern kraft pulp mills are more than self-sufficient in energy, electricity for sale.
- The steam production increases with higher black liquor dry solids and using more air preheating.
- Fossil free pulp and paper industry is emerging.



We have built bigger and more energy efficient recovery boilers

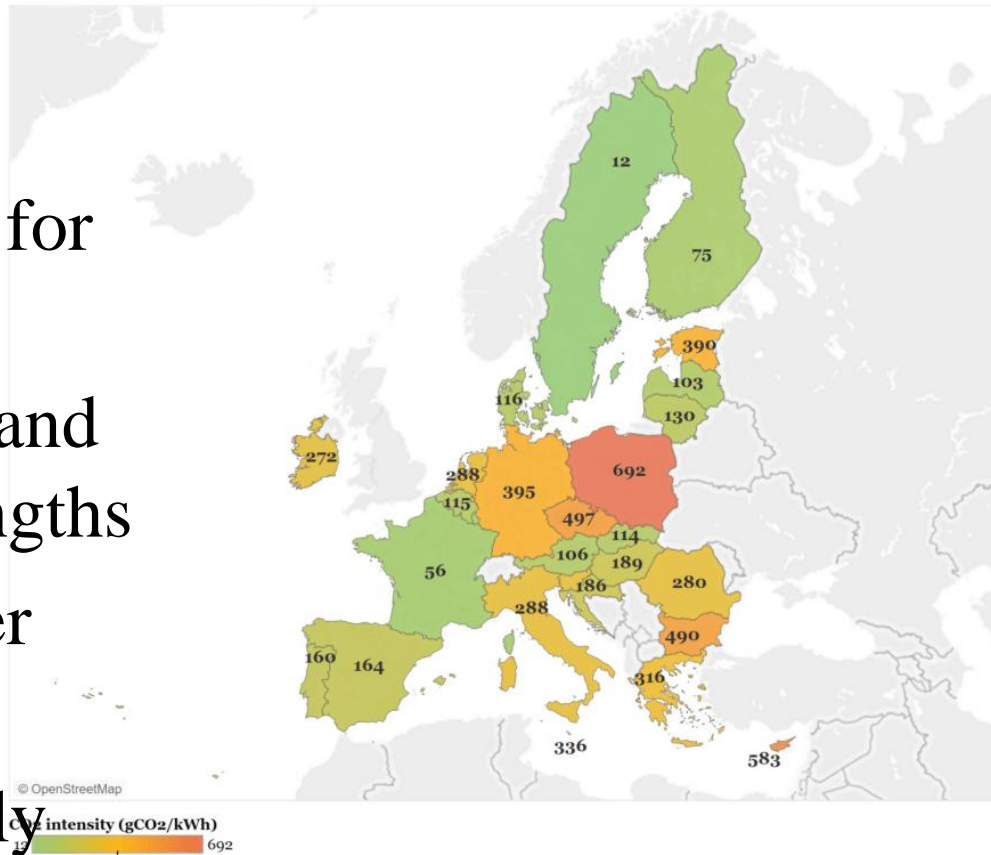




What is happening in EU

- Finnish electricity was ~33 gCO₂/kWh in 2023
- End of coal and peat use for energy is here
- Bioenergy, bioeconomy and BECCS are Finnish strengths
- ~2000 MW electric boiler capacity
- Negative prices frequently

Grid carbon intensity in the EU (2022)





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WHERE ARE WE GOING

June 5-7, 2024

60th Anniversary International Recovery Boiler Conference

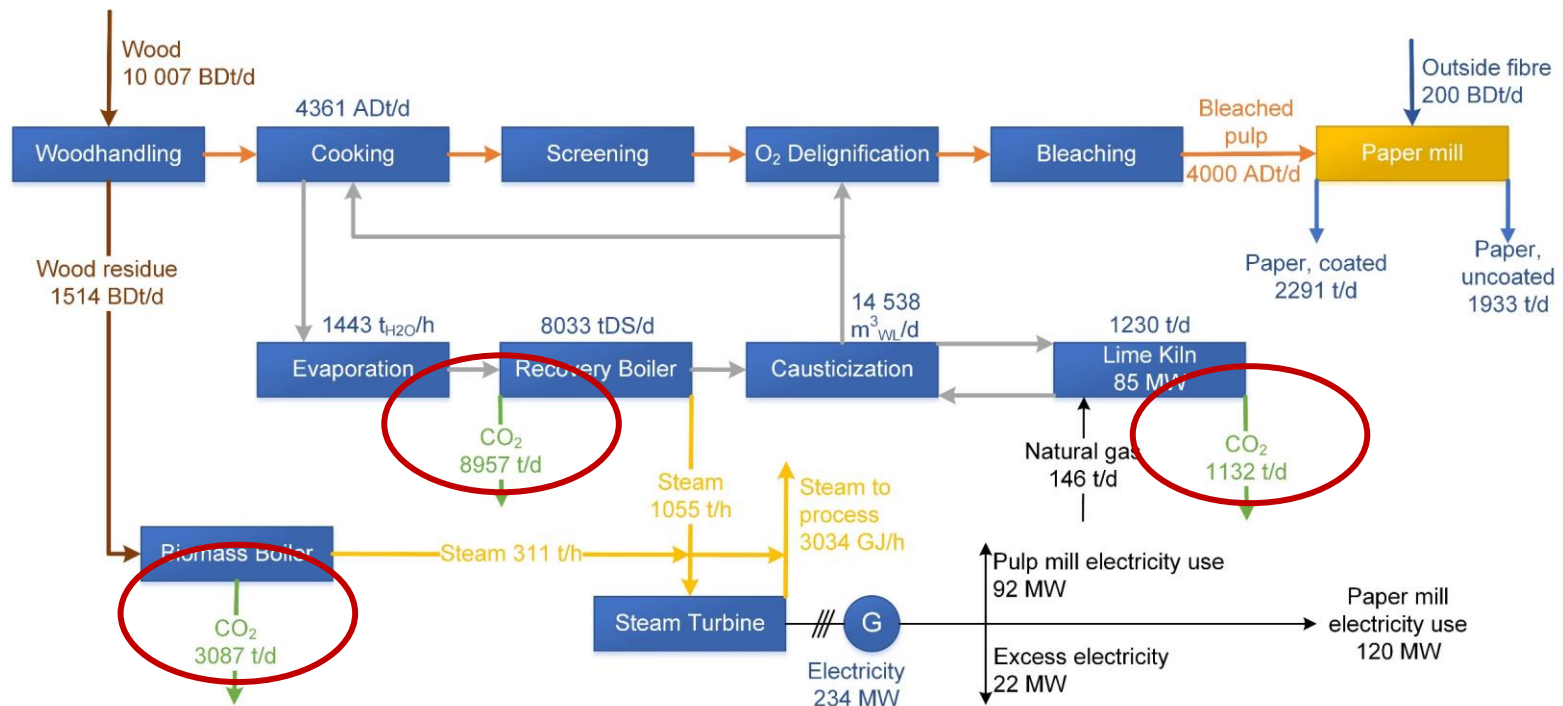


Biorefineries are emerging

- The demand and cost of energy
- Need to fight climate change.
- Call for increased use of bioenergy and biofuels.
- Integration with pulp and paper mill could make additional bioproducts more profitable.



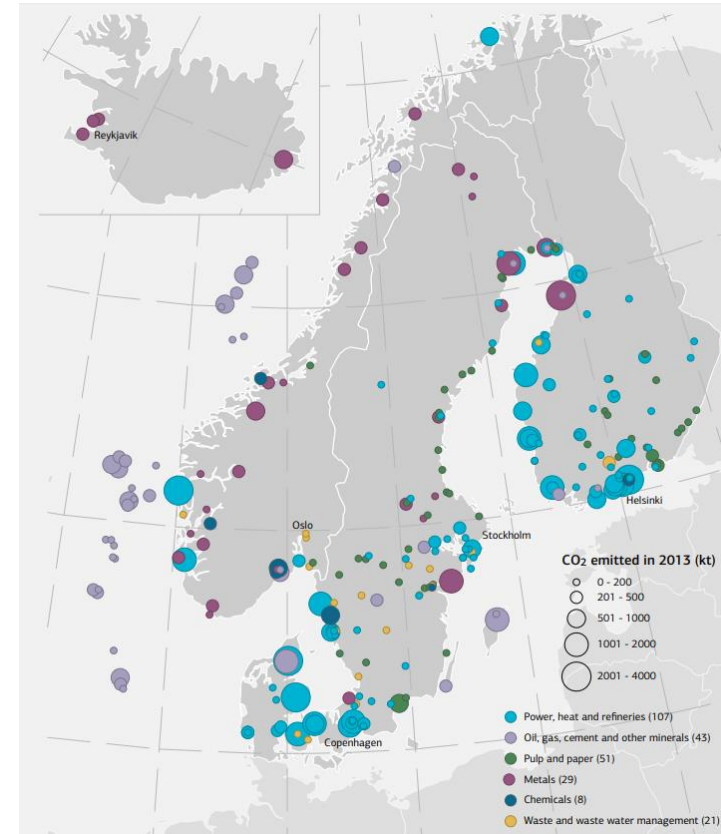
Sources of CO₂ in pulp&paper mill





Nordic is poised to lead in carbon economy

- Large low carbon electricity
- Combined with large pulp and paper sector & CHP, large point sources
- BECCS in Nordics does not require additional biomass use
- Storage possibilities in Norway
- Nordics are poised to be a powerhouse of BECCS/BECCU





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FOREST INDUSTRY 2050

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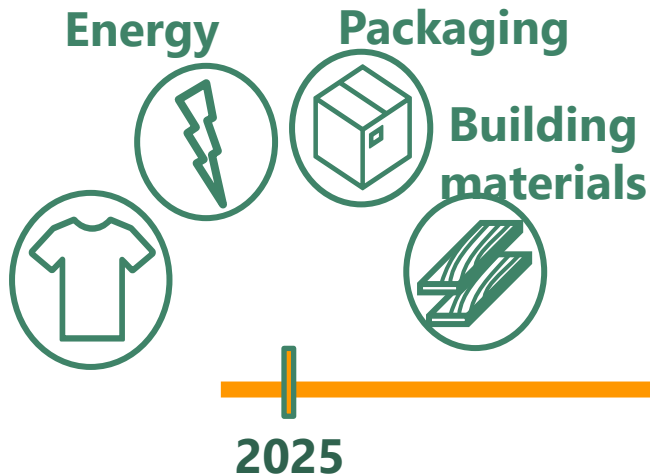
BECCS, H₂ or e-fuels?

- Biogenic CO₂ >50 MtCO₂/a
 - If 10 MtCO₂/a to methanol, value ~8 000 M€
 - Electricity 9000 MW
 - Production 7.5 MtMeOH
 - If 10 MtCO₂/a BECCS, value ~1 000 M€
 - If just hydrogen, value ~2 000 M€
 - Production 1.5 MtH₂
-

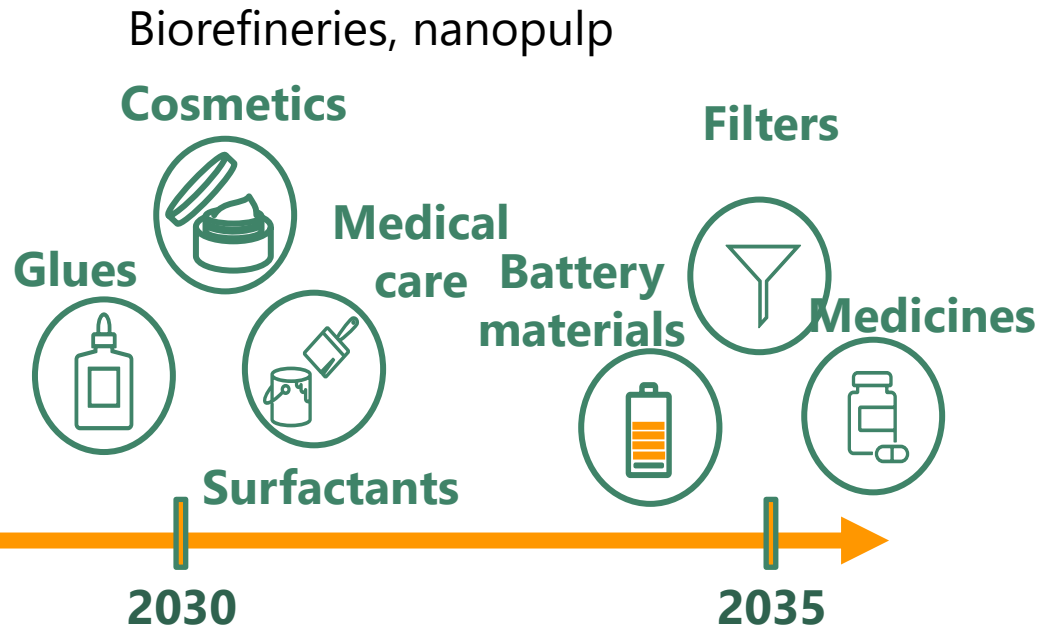


Emerging products

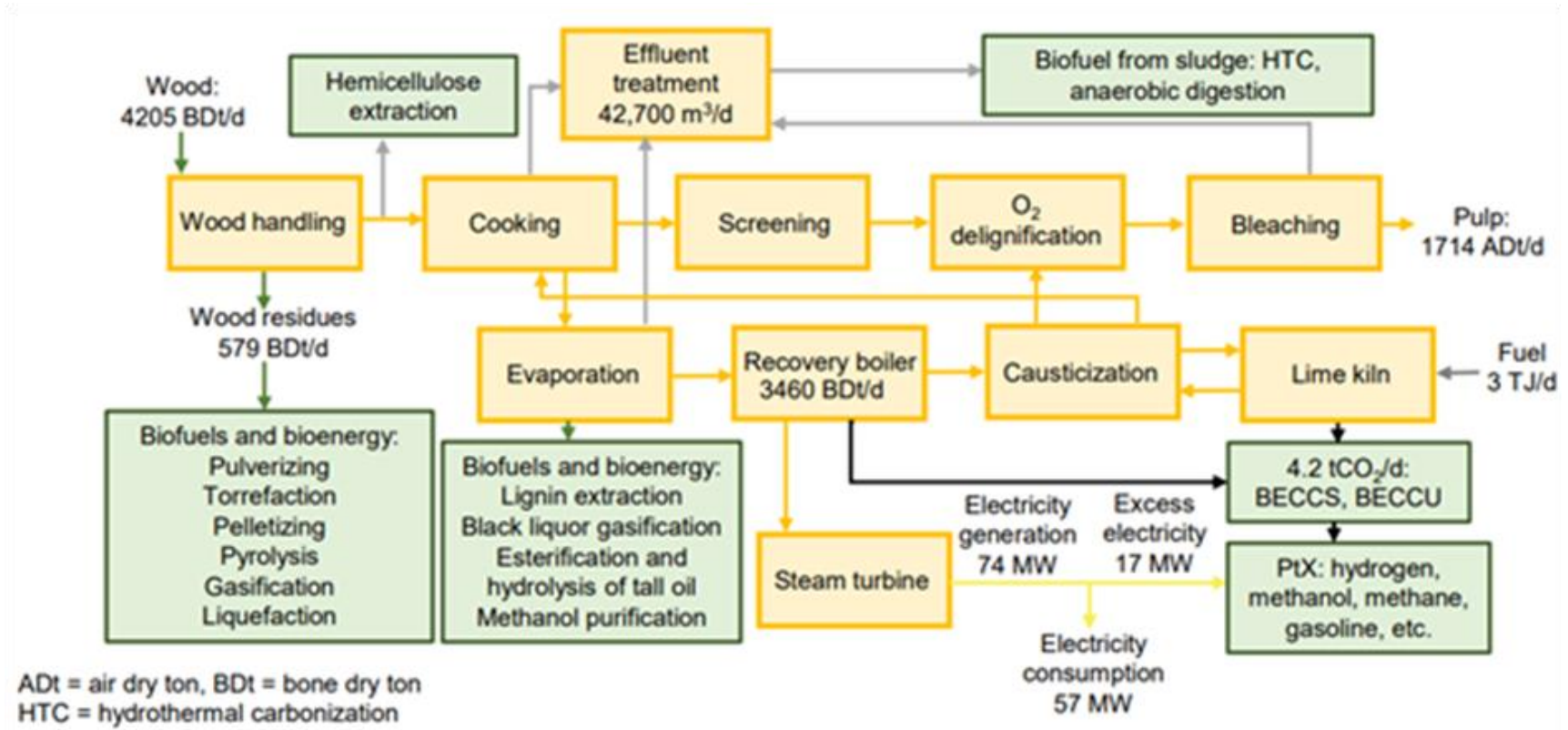
Expanding sales



Future innovations



Future possibilities





Summary

- Pulp mills and recovery will be bigger
- Several additional products manufactured
- CO₂ will be valuable
- E-products; e-methanol produced
- Maybe we will electrify lime production or drying
- Variable load because of variable e-prices