

CDRT – views and experiences from the paper industry



What is the role of the paper industry in carbon dioxide removal?



1. Carbon sink by growing forests and use of harvested wood in products (natural carbon sink), see Stora Enso carbon balance 2018 below
2. Development possibility for carbon capture and geological storage (CCS)

Our business is a net contributor to prevent global warming
13 Mt CO₂ = 325 MEUR per year

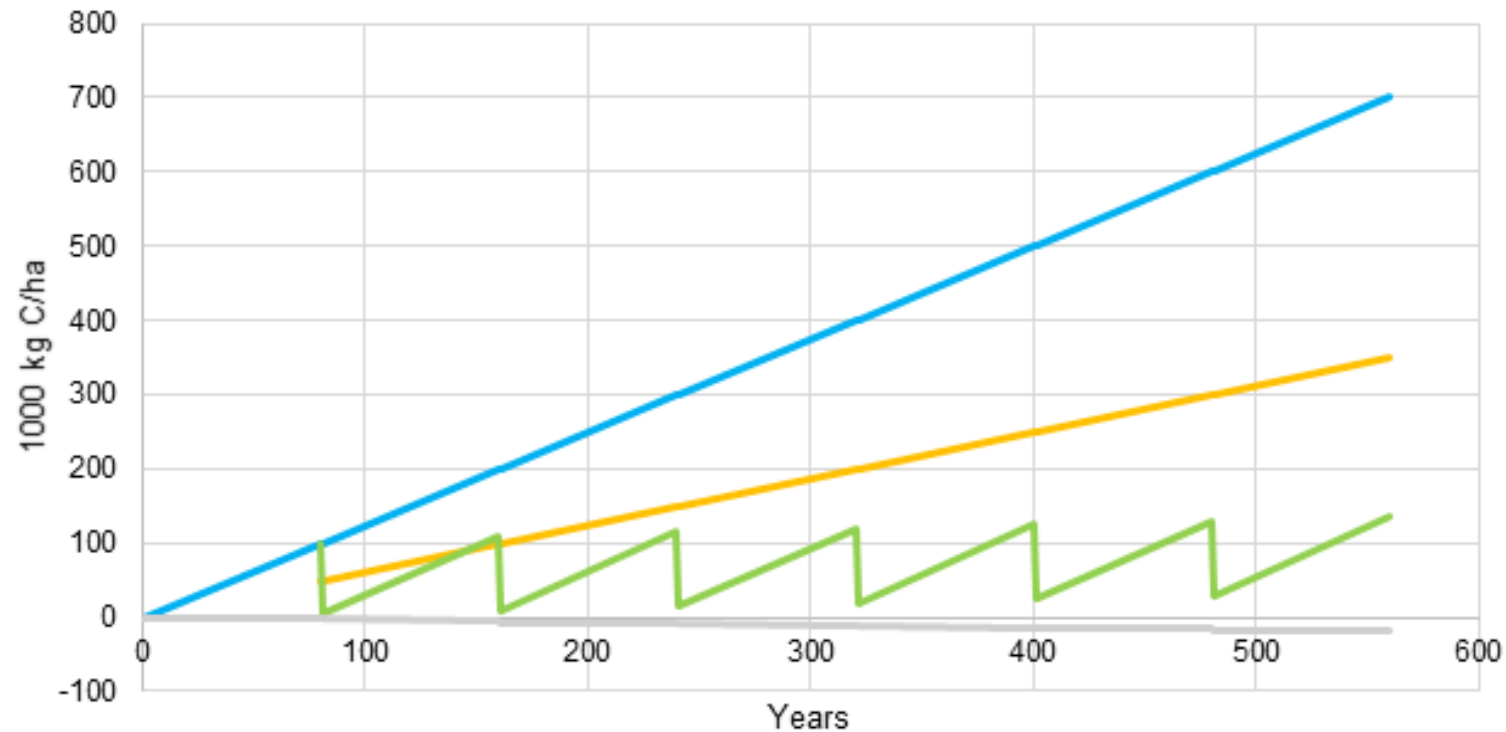
2018	Mt CO ₂
Forests	+ 3**
Value Chain	- 11
Substitution	+ 21
Total climate benefit	+ 13*

*of CO₂e per year. Source: internal calculations, value chain emissions fully adopted to the GHG protocol including Scopes 1, 2 and 3 According to the current estimates. Data year 2018 ** Accounted as an average between 2008-2018.

How does a tree-based carbon sink work?



Northern forest and wood products as a carbon sink



- Accumulative amount of sequestered carbon over time
- Carbon which is stored in wood and fibre products over time
- Carbon sink of the growing trees in a forest stand
- Accumulative operational fossil CO2 emissions over time

The Lighthouse Joensuu 14-floor residential building:



Mass of building material groups kg/m ²	
Concrete	489
Wood	202
Steel and other metals	72
Gypsum, plaster and cement	71
Insulation	22
Plastics, membranes and roofing	18
Windows and doors	12
Building systems and installations	6
Others	67

Towards NZEC: The Lighthouse Joensuu life cycle embodied carbon balance shows that the carbon stored in wood products used on the project balances 88% of the embodied carbon from all construction products used on the project.



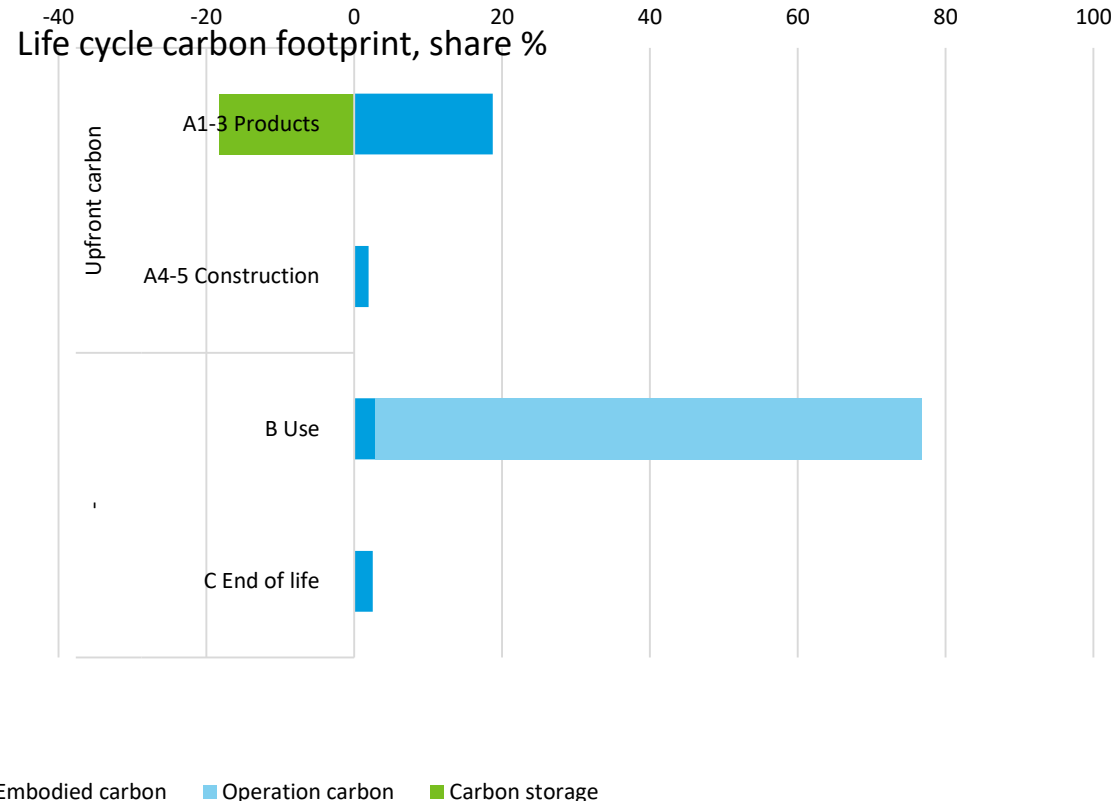
Carbon emissions

Embodied carbon is the greenhouse gas emissions associated with materials and construction processes throughout the whole life cycle of a building or infrastructure.

Upfront carbon emissions result from material production and construction phases of the life cycle before the building or infrastructure begins to be used.

Operational carbon emissions are generated by the energy used to operate the building or infrastructure.

Carbon storage refers to carbon removed from the atmosphere and stored as carbon in a product.



Life cycle assessment scope

The assessment had a 60-year lifespan, including all main building materials and installations, material transport and construction activities, the use phase, and end-of-life scenarios.

- Life cycle modules included:
- A1–3 Product stage
 - A4–5 Construction process stage
 - B4–5 Use stage: Material replacement and refurbishment
 - B6 Use stage: Operational energy use
 - C1–4 End of life stage
 - D Benefits and loads beyond the system boundary

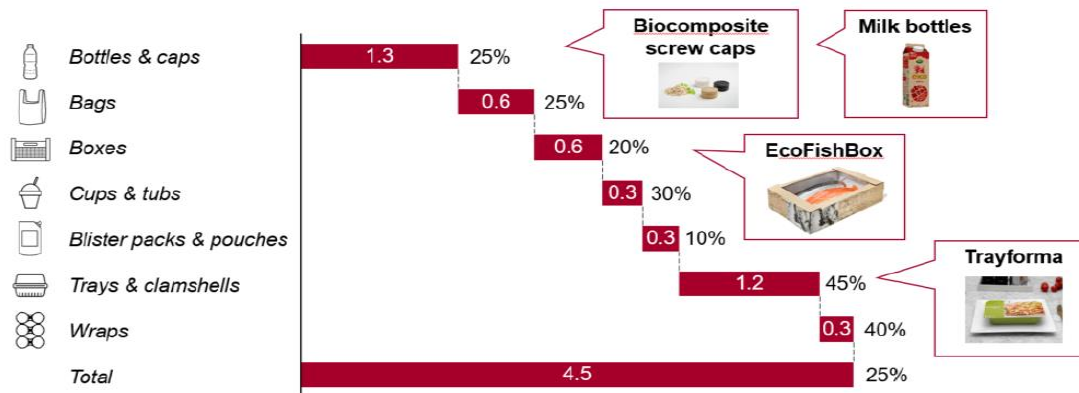
From LCA to Circular economy

- Building or Material passport can give the possibility to check the possible reuse or recycling of building elements after the use period
- Thus, carbon storage period can be extended by reuse or recycling.

SUBSTITUTION POTENTIAL UNTIL 2030

25% of plastics in packaging can be replaced today...

Plastics packaging substitution potential
Mt plastic packaging, net potential



Total wood frame building projection Europe 2030

- Market-driven scenario: market share possibly 5%*
- Policy interventions scenario: market share possibly 10%

* factors: living/working preferences, building codes, architectural designs, BIM

CCS/CCS for pulp and paper mills



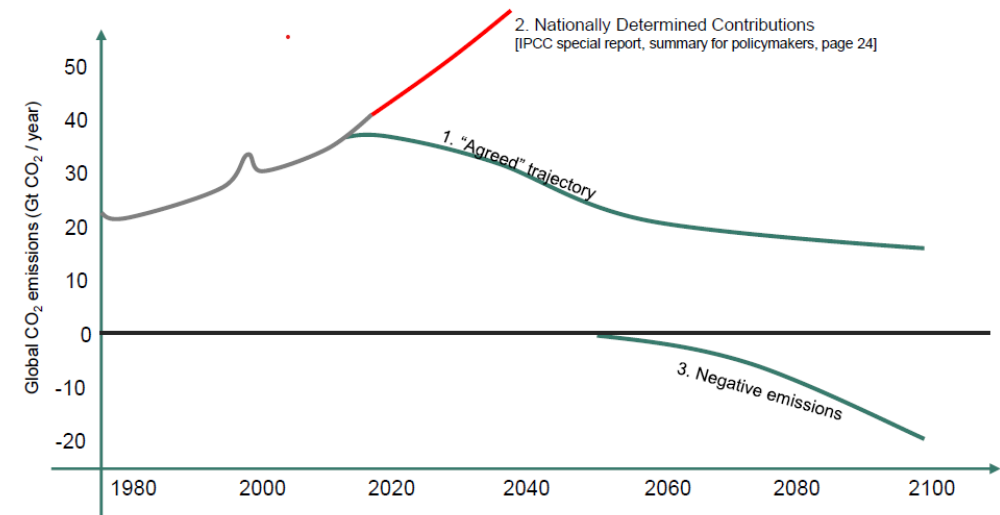
- CCS: transport and deposit cost estimated at 60€/t of CO₂ plus CO₂ separation OPEX and CAPEX at mill site. Against current levels of EU ETS certificates prices CCS is not economically viable.
- CCU: volume of CO₂ per mill which could be separated is comparatively low, thus symbiosis with chemicals producers using such CO₂ does not seem to be a promising business model.
- Outlook 2050+: The electrical mill could be the more promising long-term future. Assuming that enough green electricity at competitive prices will be available mill energy systems could be operated by electricity supply only and the necessary process steam would be generated by electrical boilers. In the meantime natural gas and biomass remain the key fuels for European mills.

Options for a framework to incentivize CDRT



- Better define CDRT:
 - What is the minimum storage time of CO₂ necessary?
 - How to take into account CO₂ stored in products in a circular economy?
- Carbon sinks: possible market mechanisms
 1. Voluntary market, as carbon offsets options outside EU are shrinking
 2. “Demand driver”: industrial users of CO₂
 - This could work as the EU ETS certificate market
 - Example in our industry: PCC mineral production on-site

Emissions development



Common Agricultural Policy: Afforestation in Europe



- A new view on forestry: a mosaic landscape is created to serve both habitat concerns and productive harvesting
- Pictures taken in June from a wood harvesting site in Sweden



CCS/CCU for fossil fuels?



- CDRT for fossil fuels such as oil and coal should not be incentivized, as these are not renewable fuels.
- Incentives for natural gas CDRT could be considered for a transition period, until enough “green gas” or hydrogen would be available.

BECCS?

- Bioeconomy: Wooden fibers should be primarily used for products.
- Demand for product substitution by fiber based products is growing in packaging and building industries.
- Incentivizing BECCS could be contradictory when pushing for a bioeconomy