Environmental aspects of renewal towards circular bio-economy

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With contributions from the RECIBI team
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Methodology

- Life Cycle Approach
- Identifying differences between “traditional” and new processes and products
- Identifying the key circular economy elements of forest-based manufacturing industries

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Textiles

Oil-based man-made fibres

Production of polyester contributes to the depletion of non-renewable natural resources and increases the dependence on fossil oil.

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Textiles

Cotton

Production of cotton is water intensive and competes with food production.

Globally, cotton production is responsible for about 3% of the global water use.

Cotton monoculture fields require the use of pesticides and fertilisers.

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Textiles

Offshoring

Offshored production increases the need for long-distance transport, as well as raises social issues related to safety, heath impacts, income inequality and human rights.

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Textiles

New wood-based regenerative fibres

Climate impacts of their production can be up to nine times lower compared to conventional fibres.

Boreal forest does not need irrigation, neither pesticides.

Production of fibres does not require potentially harmful solvents, as viscose production does (e.g. carbon disulphide).

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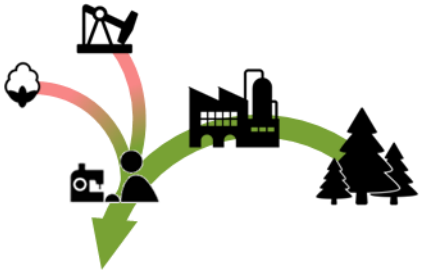
Textiles



Post-renewal

Increased production of new wood-based regenerative fibres in Finland, Sweden and globally may lead to a decreasing production of cotton and oil-based fibres and lowering overall environmental impacts.

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Use

The use phase can dominate life cycle climate impacts of textiles!

Design and consumers' behaviour play an important role.

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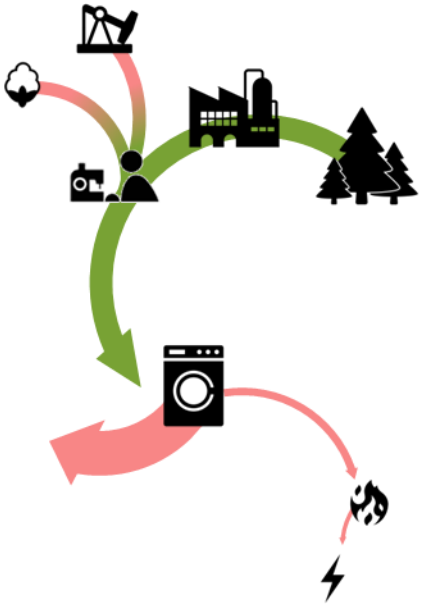
Textiles



End-of-life

Globally, most used textiles still end up in landfills or incineration. The decomposition of textiles at landfill contributes to carbon dioxide and methane emissions. Materials are lost.

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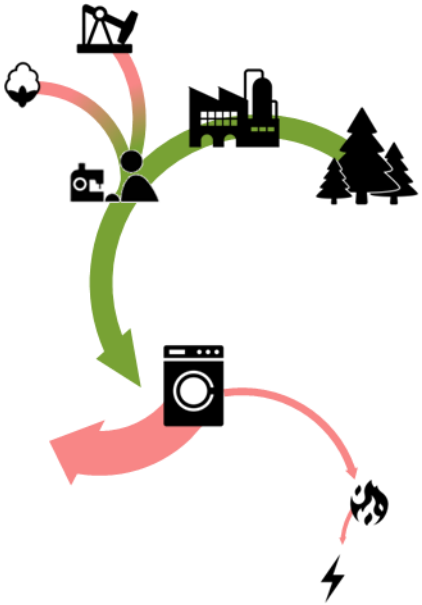
Textiles



End-of-life

Currently, in Finland 82% of all waste textiles are incinerated, while in Sweden some 55% enters municipal waste streams and circa 25% is unaccounted for.

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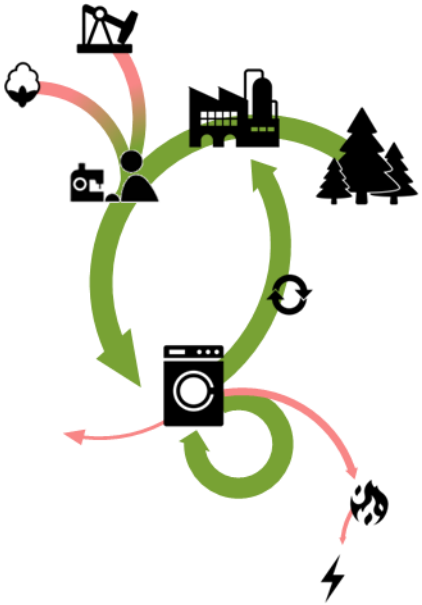
Textiles



Circularity

Diverting textile waste from landfills, increasing durability, re-use and recycling.

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Textiles

Environmentally extended input-output model ENVIMAT^{scen} used for macro-level assessment. Two scenarios were compared to the reference.

ENVIMAT^{scen}				
	Reference	Extended lifetime	Viscose	Combined
GDP Billion € (in 2010 prices)	228	+4.5	+2.7	+6.1
Employment, in 1000 man years)	2497	+50.8	+37.5	+72.3
Raw material consumption (RMC) Mt	164	+4.7	+2.9	+6.4
RMC/GDP, g/€	717	+6.2	+4.3	+8.8
Greenhouse gas emissions (GHG), Mt CO_2-eq.	45	+0.6	+0.4	+0.8
GHG/GDP, g/€	199	-1.4	-0.8	-1.9

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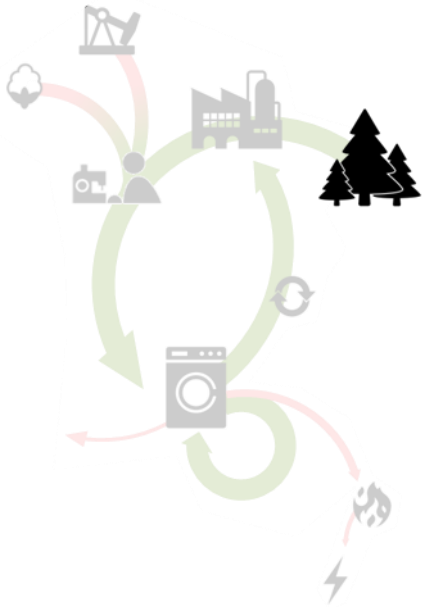
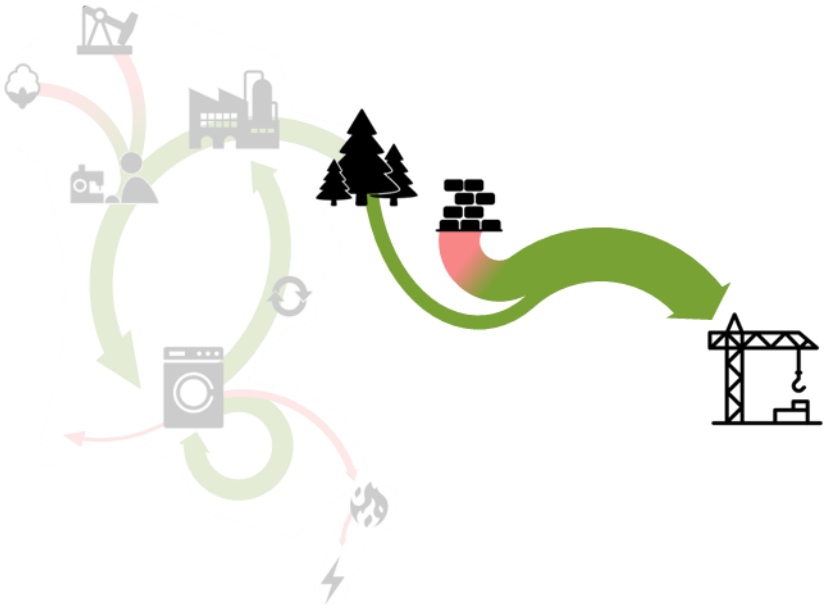
Construction



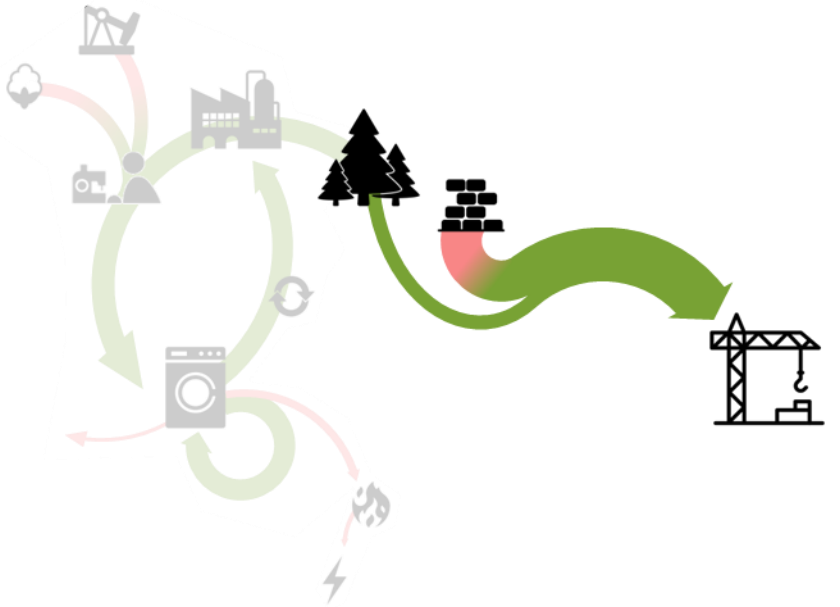
Construction



Concrete

Cement in concrete buildings accounts for most of the CO_2 emissions during their construction.

Construction



Wood

Wood is a renewable building material. It binds carbon dioxide from the atmosphere and wood buildings act as carbon storage.

The use of bioenergy in wood processing lowers its climate impacts.

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Construction

Use

80-90% of the total energy use and CO_2 emissions in buildings are generated during the use phase.

Material selection affects energy efficiency.

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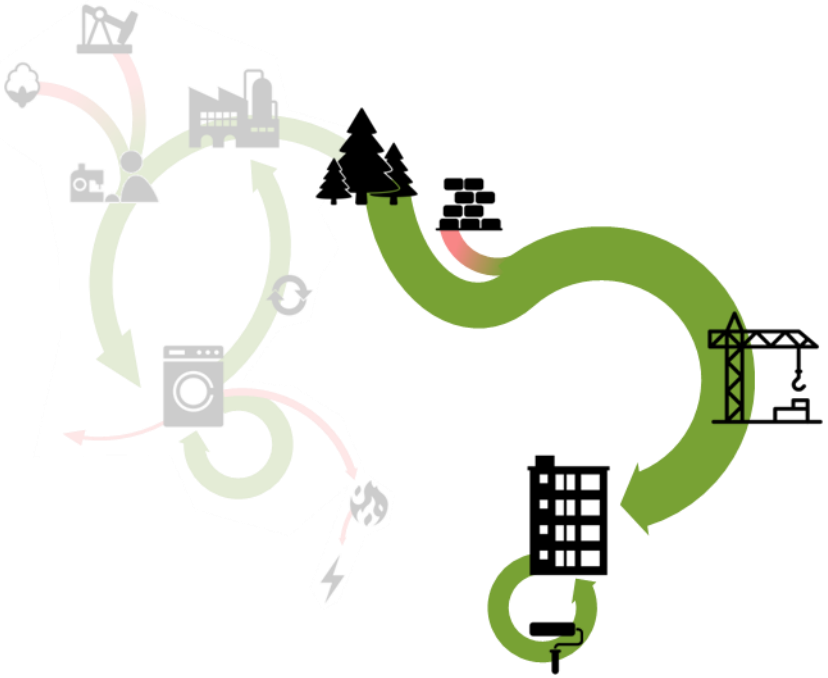
Construction



Extending life time of buildings

Modularity and repair prolongs the lifetime of buildings.

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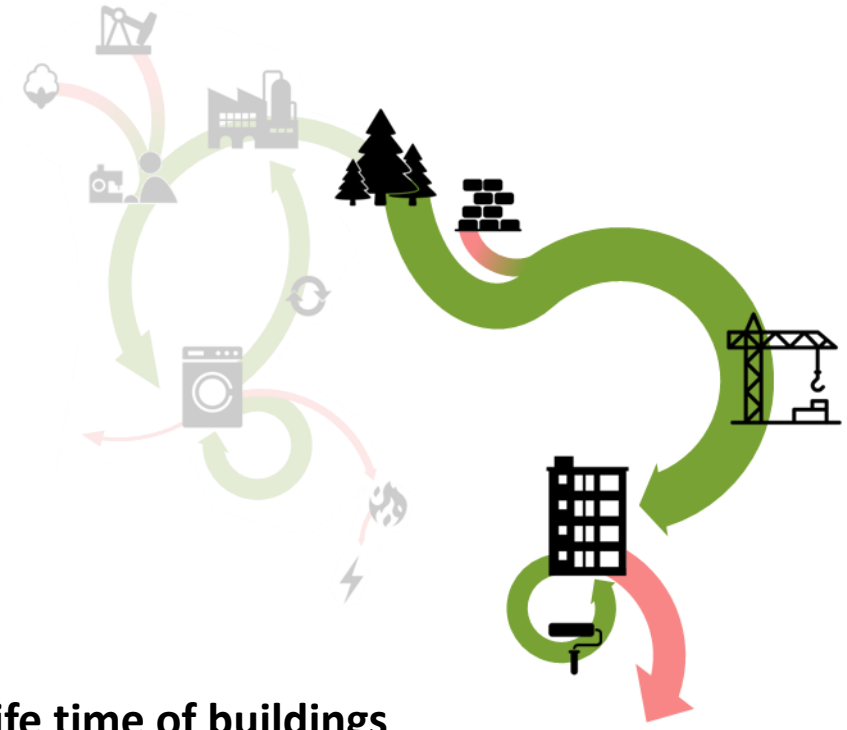
Construction



Extending life time of buildings

Modularity and repair prolongs the lifetime of buildings.

Construction and demolition waste can be limited by modular construction and prefabrication.

Construction

Circularity

Recycling of building materials lowers the need for extraction of virgin raw materials.

However, chemically treated, or painted, wood is classified as hazardous waste and cannot be recycled at the moment.

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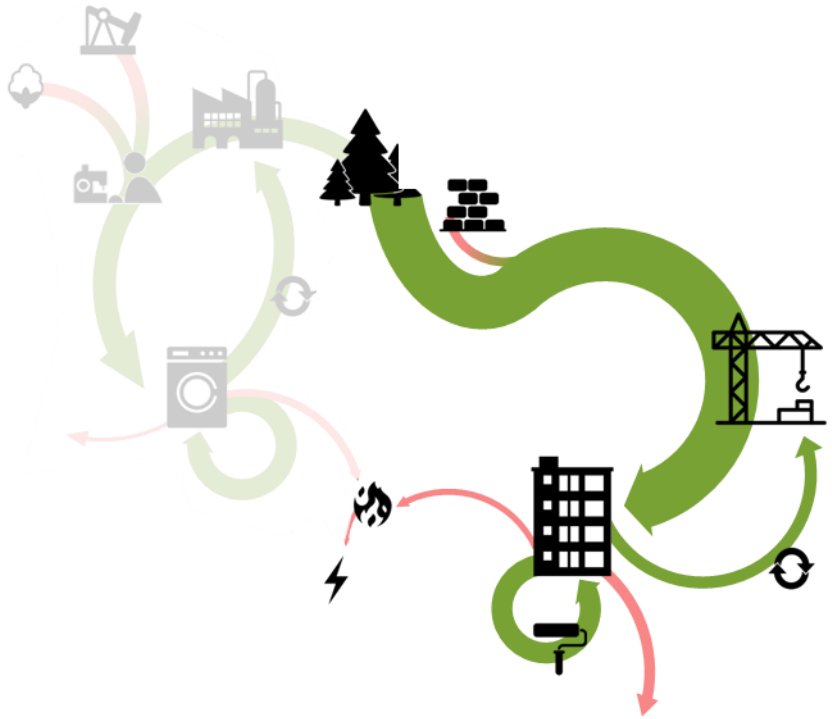
Construction



Wood buildings act as carbon storage and can be recovered for energy at the end of life.

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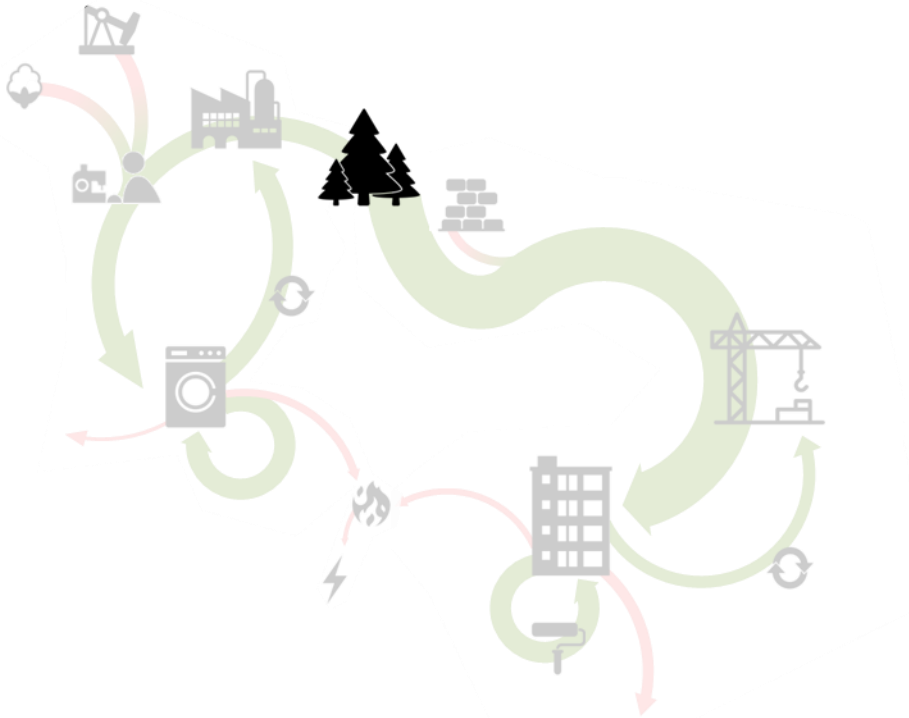
Biorefineries



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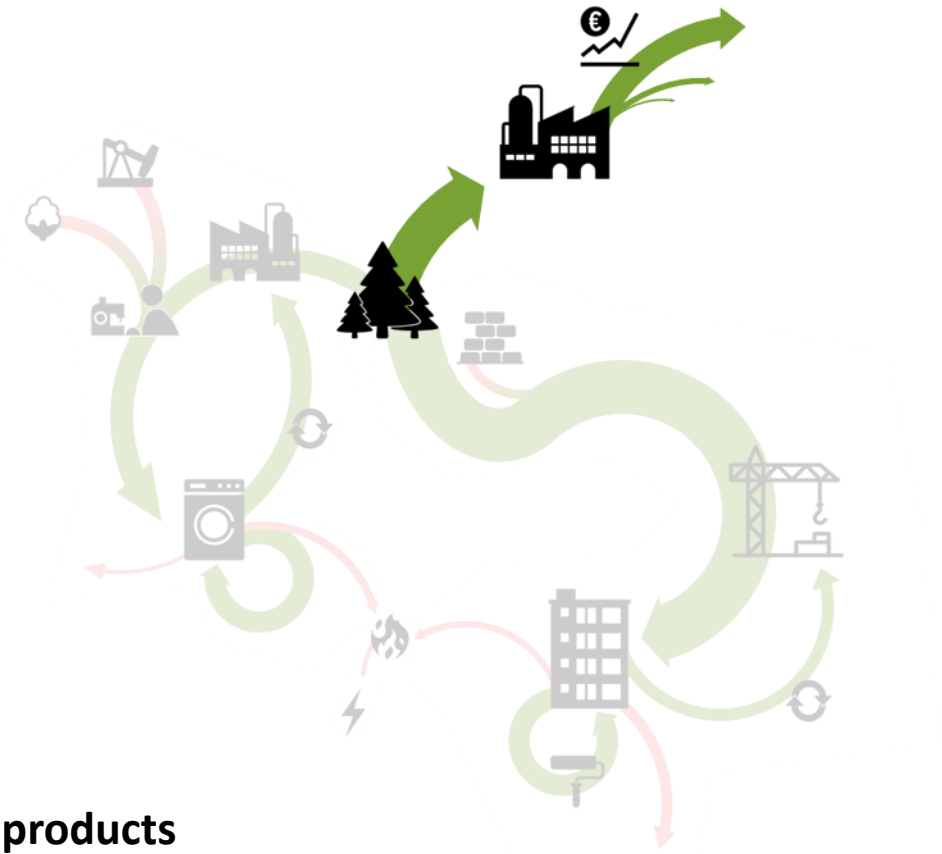
Biorefineries



Value-added products

The main environmental benefit of new value-added products comes from replacing fossil-based products, as well as from utilisation of currently unutilised process by-products.

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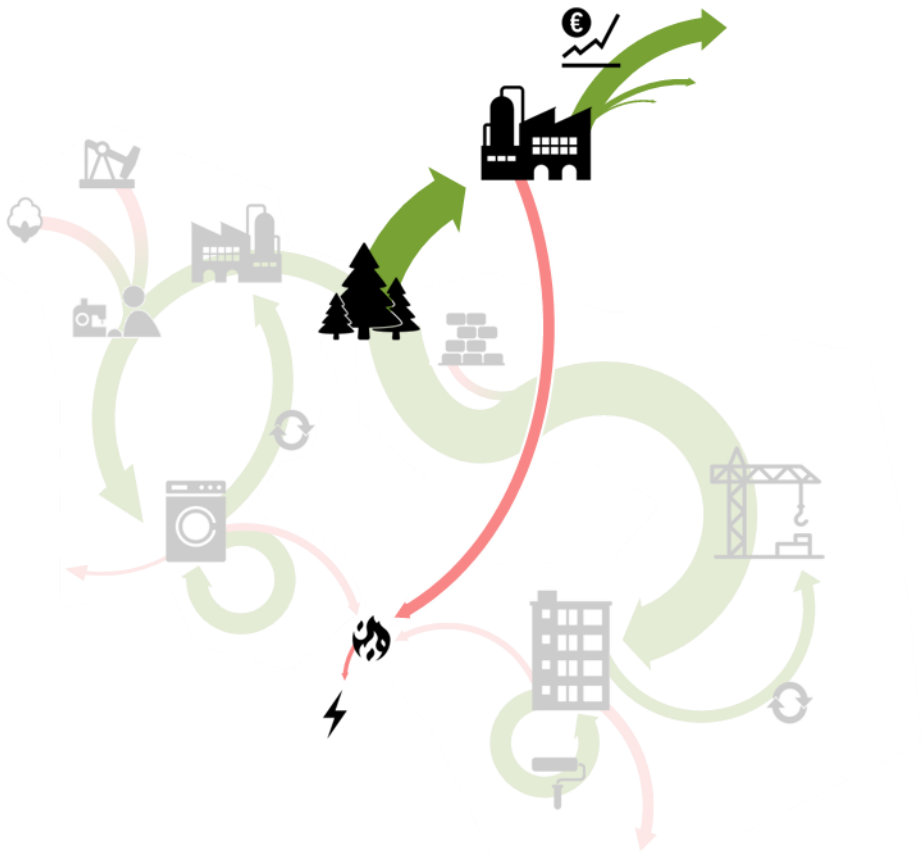
Biorefineries



Biofuels

Although made out of renewable resource, the high production volumes raise concerns about the sustainability of wood biomass-based biofuels.

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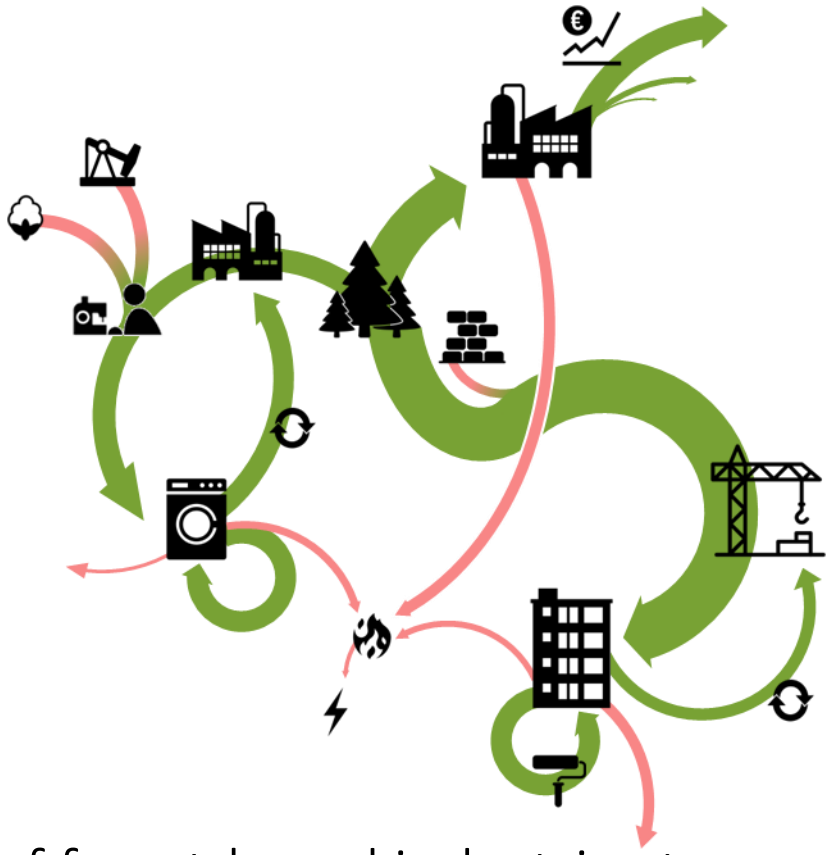

Renewal of forest-based industries towards circular bio-economy **by RECIBI**

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References

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