Resource efficiency and GHG emissions of wood product cascading and bioenergy in the EU

Journal of Cleaner Production Vol.172 (2018)
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European Biomass Conference & Exhibition (EUBCE) – 29 May 2019

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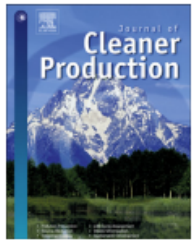
JCP Article

Journal of Cleaner Production 172 (2018) 3942–3954

Contents lists available at ScienceDirect

Journal of Cleaner Production

journal homepage: www.elsevier.com/locate/jclepro



Assessing wood use efficiency and greenhouse gas emissions of wood product cascading in the European Union

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JCP Article (continued)

EC Policies beyond 2020*

Resource efficiency: EC promotes sustainable use of wood in construction;

This study applies:

$$CF = 1 + ((RW + IR)/WR\ forest)$$

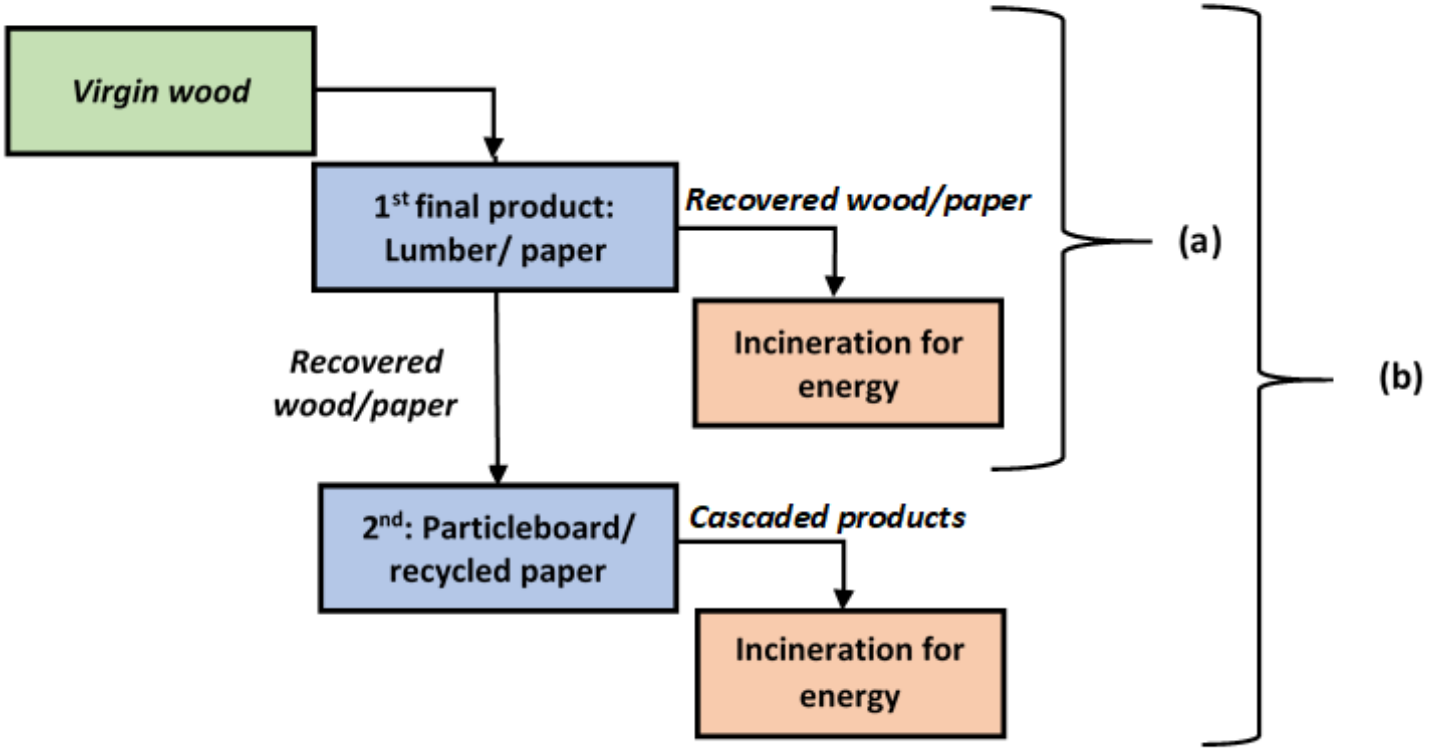
- RW = Recycling in wood products, recovery in energy
- IR = industrial wood residues in products, industrial wood residues energy

WR = Wood resources from forests (domestic used extraction + net import)

GHG emission reduction: EC promotes the use of renewable energy resources (i.e. woody biomass).

This study considers: wood product recycling, energy use; waste prevention

Cascading principle



Wood utilization chains applied: **(a) short utilization chain** – direct interactions of discarded wood products for energy generation; **(b) long utilization chain** – product recycling of discarded wood products before utilizing it for energy generation

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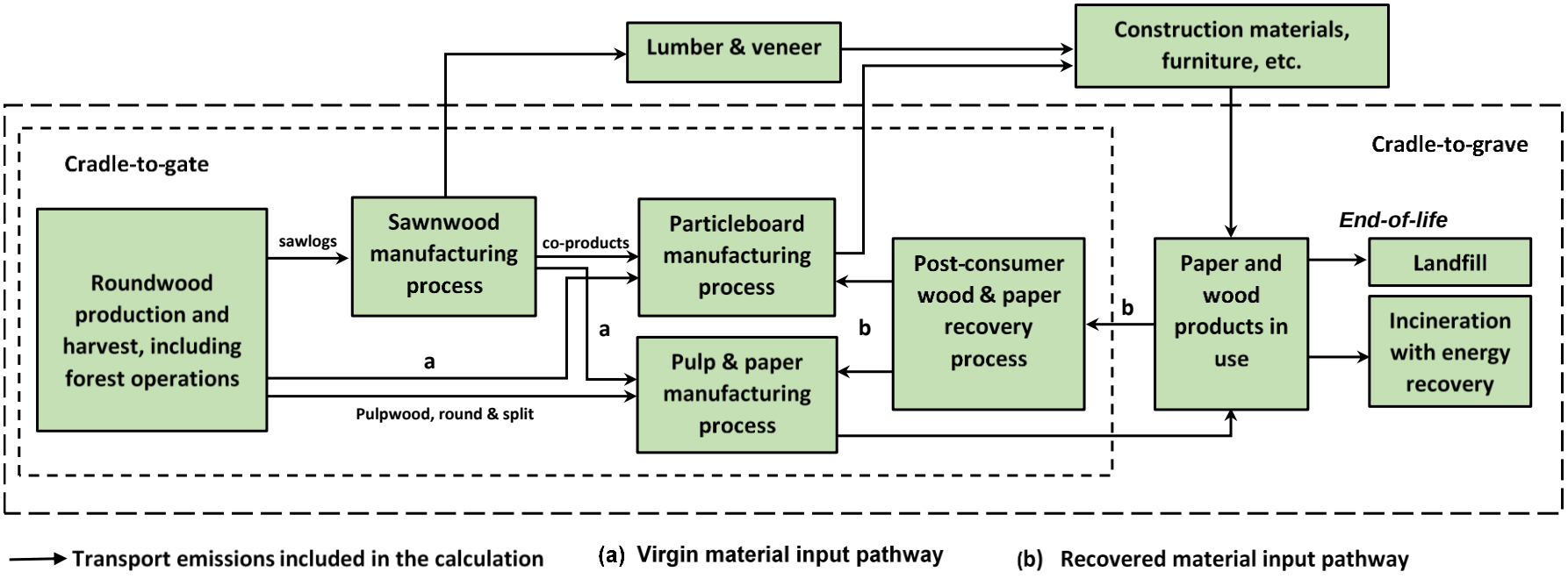
System boundaries



System boundary of the paper and particleboard lifecycle model followed. Lifecycle stages of the paper and particleboard manufacture by utilization of **(a) virgin fibre** and **(b) recovered fibre** as raw material input and the two end-of-life alternatives.

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Scenarios

	No product cascading (S0) rates in %	State of art recycling (S1) rates in %	Optimized future wood product cascading (S2) rates in %
waste wood collection rate	0	30	45
waste wood re-utilization rate	0	27	41
use of virgin fibres (wood based pane)	**100**	**73**	**59**
waste wood collection rate	0	66	78
waste wood re-utilization rate	0	51	61
use of virgin fibres (paper products)	**100**	**49**	**39**

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Results of cascading factor

Total wood resource balance

	No product cascading (S0)	State of art recycling (S1)	Optimized future wood product cascading (S2)
Cascades in wood product	1.09	1.34	1.43
Residues & recovered wood in energy	1.56	1.26	1.28
Total Cascade Factor (CF)	1.65	1.6	1.71

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Results GHG emission reduction

	No product cascading (S0) Absolute change towards (S1)	State of art recycling (S1)	Optimized future wood product cascading (S2) Absolute change towards (S1)
Wood sector GHG emissions	28	0	-7
Energy sector GHG emission savings	-43	0	-1
Waste sector avoided GHG emissions	7	0	-6
Total change of GHG emissions	-8	0	-14

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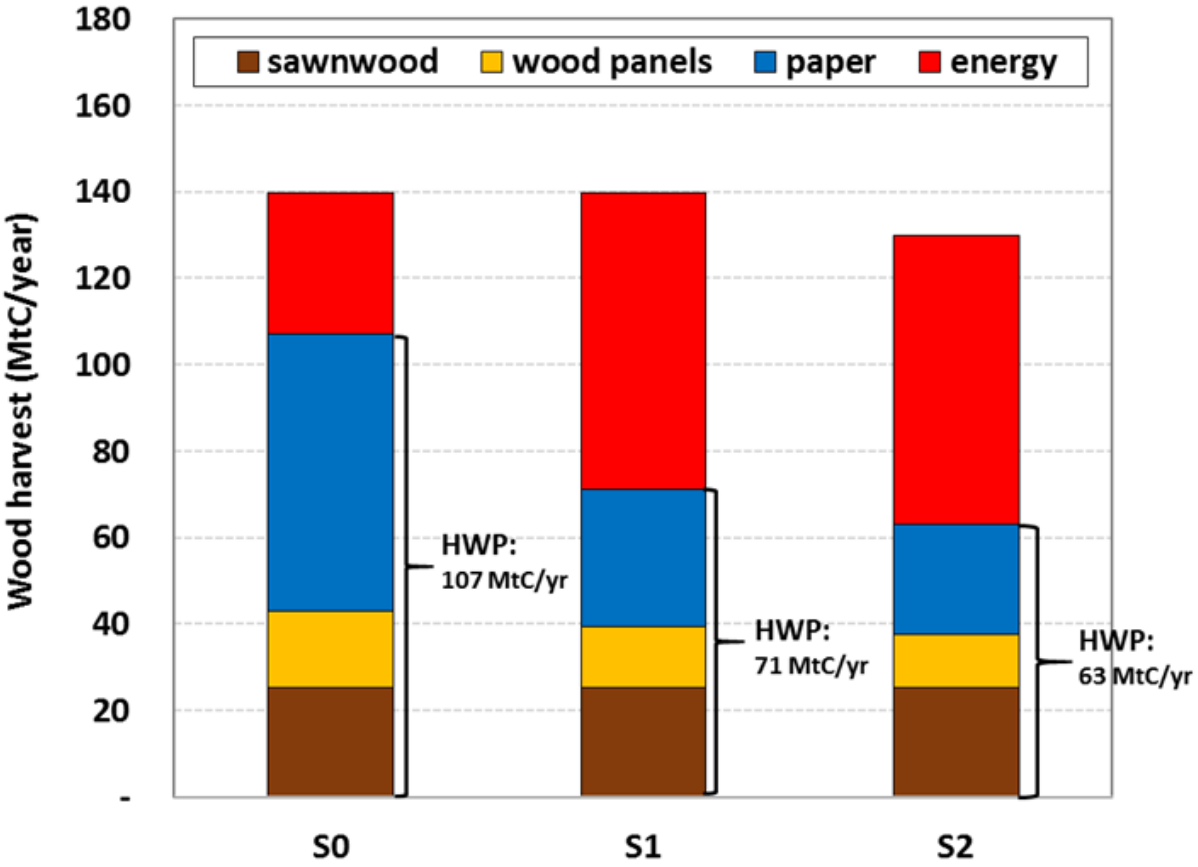
Total wood resources



Total wood harvest in Mega tonne Carbon per year showing C uptake of different wood uses in three wood utilization scenarios: **(S0) no product cascading**, **(S1) state-of-the-art wood** and **(S2) paper recycling and optimized future product cascading**

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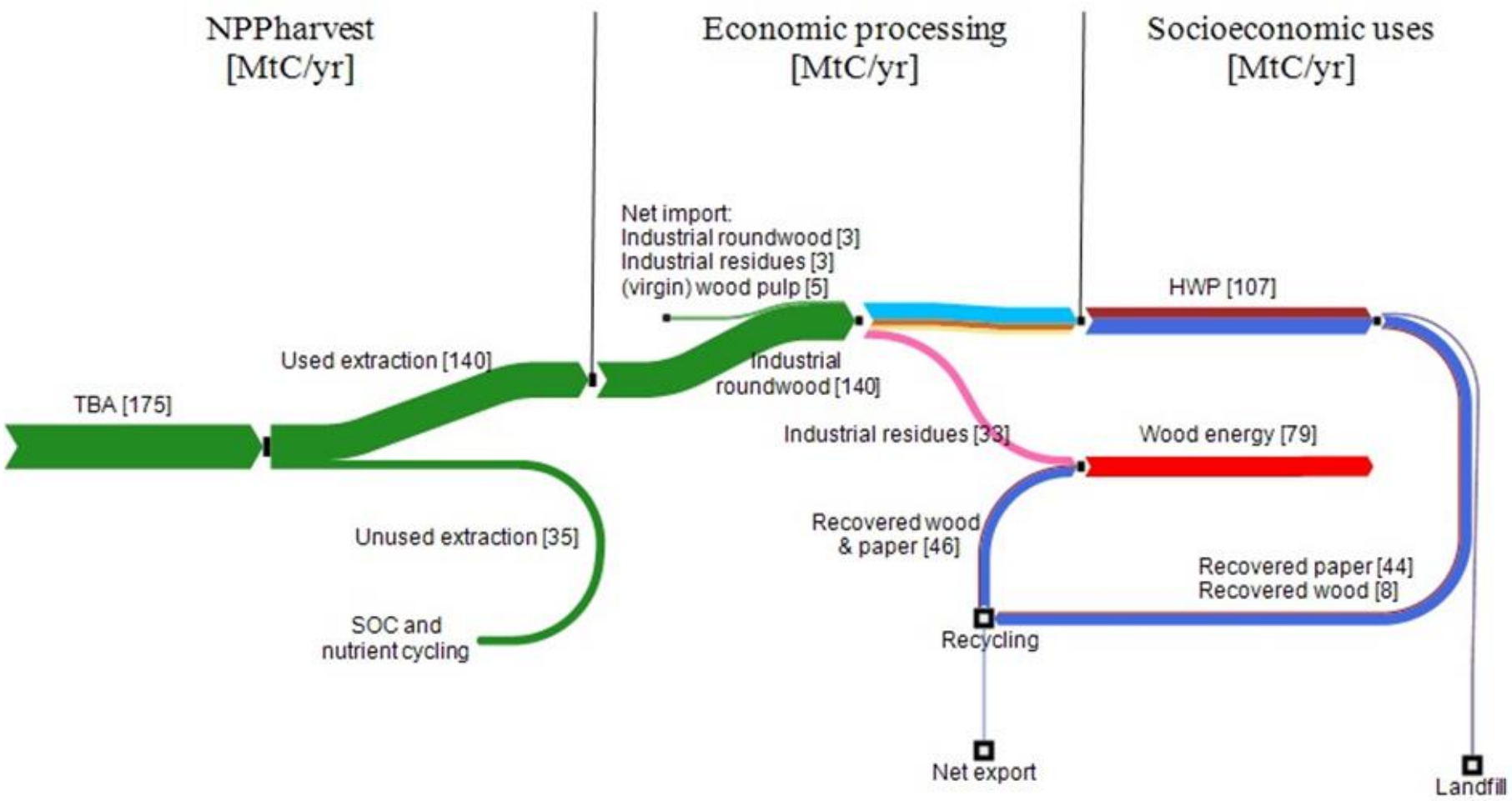
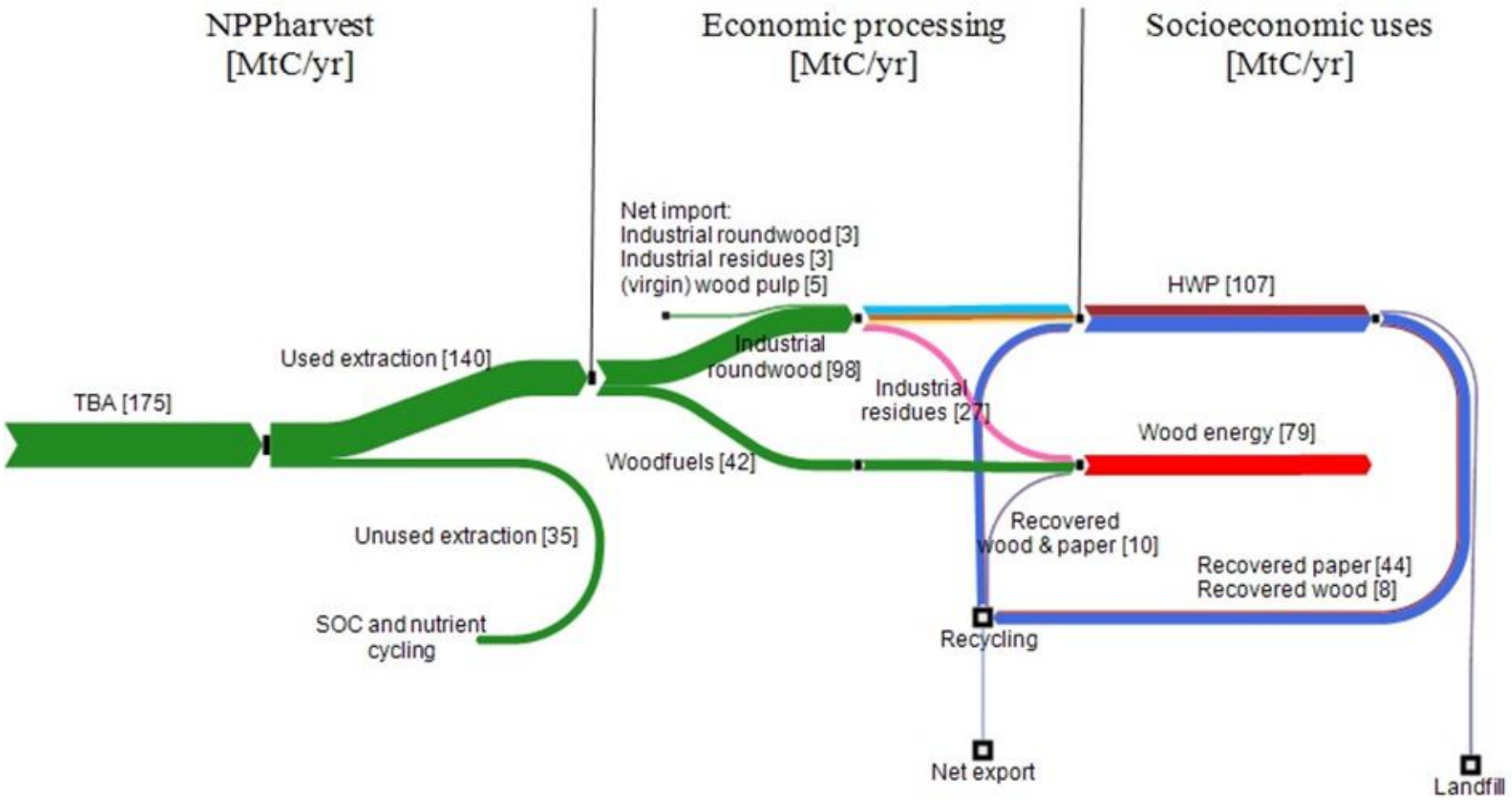
No product cascading (SO scenario)



Current practices wood & paper recycling (S1 scenario)



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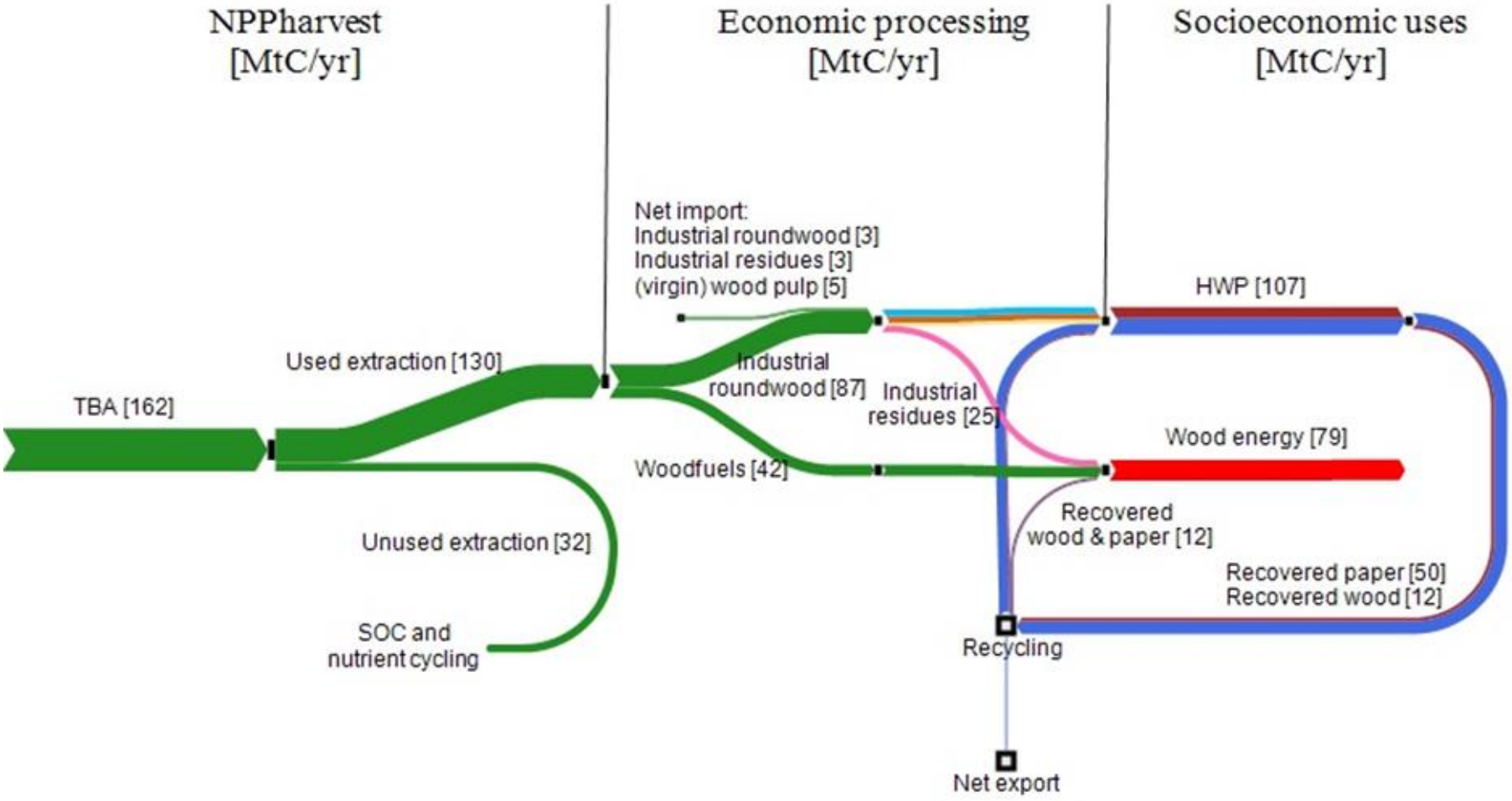
Optimized future product cascading (S2 scenario)



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Take home messages

Cascading of biomass contributes to EU goals for resource efficiency & GHG emission reduction

Optimised cascading (in comparison with BAU)

- Wood use efficiency ratio increases by 9%
- 14 MT yr^{-1} more GHG savings in wood production, energy and waste sectors

No product cascading (in comparison with BAU)

- Wood use efficient ratio strongly decreases by 25%
- 8 MT yr^{-1} more GHG savings, where positive energy sector effects are counteracted by negative wood production effects (use of fresh fibres instead of waste)

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References for further reading

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- Clean energy for all Europeans (com/2016/860 final)
- Mantau, 2015 wood flow analysis, in Biomass & Bioenergy 79: 28-38
- Bais-Moleman AL, Sikkema R, Vis M, Reumerman P, Theurl MC and Erb KH, 2018. Assessing wood use efficiency and greenhouse gas emissions of wood product cascading in the European Union. In: Journal of Cleaner Production
- R Sikkema et al 2013. The GHG contribution of the cascaded use of harvested wood products in comparison with the use of wood for energy – A case study on available forest resources in Canada. In: Environmental Science & Policy.

Any questions?

Colorful EU forests

Sustainable harvests

Bio economy & renewable energy

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