1-platform (black liquor) biorefinery to produce pulp, lignin and energy from wood chips

Part A: Biorefinery plant

Using wood (round wood) in a commercial scale kraft pulp mill, providing Kraft pulp, Kraft lignin and energy. The system boundaries are set cradle to gate, starting at the forest operations (incl. planting, thinning, harvesting etc.), the pulping process and the lignin extraction via the Lignoboost process. Considered products are: pulp as main product and reference flow, lignin as by-product and an energy surplus (electricity to the grid). The assumptions are based on a state of the art kraft pulp mill, with an annual capacity of 600,000 Adt pulp. The lignin extraction is assumed to be 15% in order to still be able to provide enough energy to cover the mill's energy need. Natural gas is assumed as auxiliary fuel.

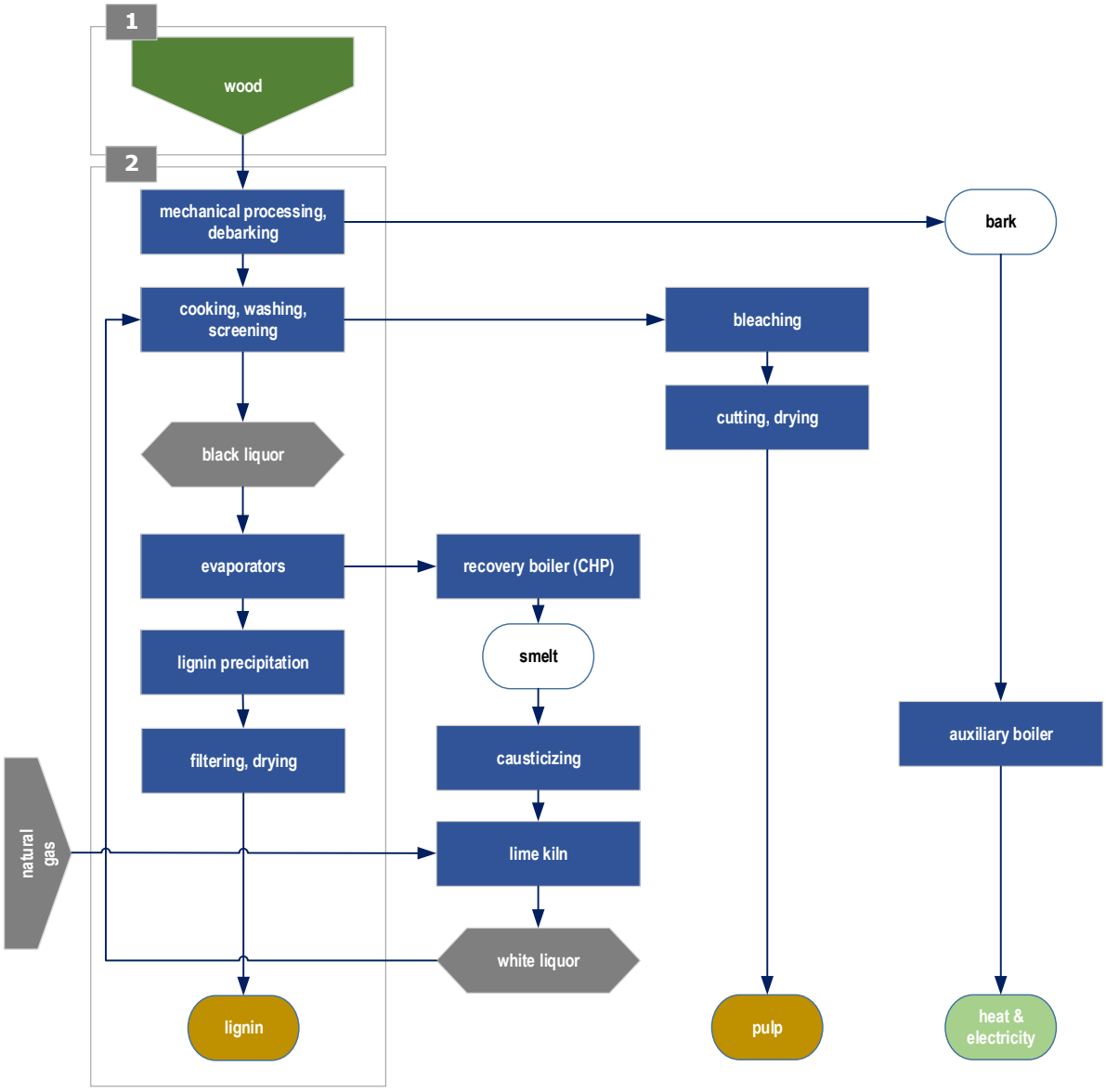

Figure 1: 1-platform (black liquor) biorefinery to produce pulp, lignin and energy from wood chips

Funding provided by Federal Ministry Republic of Austria Transport, Innovation and Technology FFG Promoting Innovation.

Key characteristics

1-platform (black liqour) biorefinery using wood chipsfor the production of Kraft pulp, Kraft lignin and energy					
State of technology	Demonstration/commercial (TRL 7-9)				
Country	EU 27				
Main data source	Wood K plus				
Products			**Auxiliaries (external)**		
Pulp	600,000	t	Energy	780,000	GJ
Lignin	70,427	t	Chemical inputs	139,453	t
Heat	1,478,632	GJ			
Feedstock			**Costs**		
Round wood	1,549,200	t	Investment costs	11,000,000	€
			Feedstock costs	1,549,200	€
Lignin extraction rate	15	%	Number of employees	135	#
Efficiencies					
Pulp to lignin	8.5	t/t lignin	**Reference flow**	**600,000**	**t pulp**
Black liquor to lignin	10.8	t/t lignin			

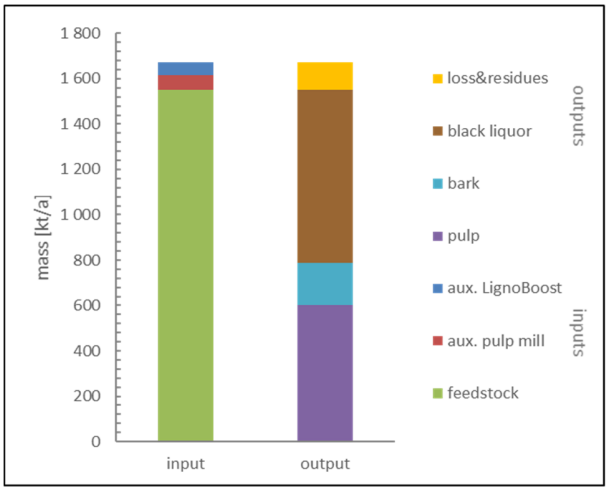

Figure 2: Mass balance of biorefinery plant

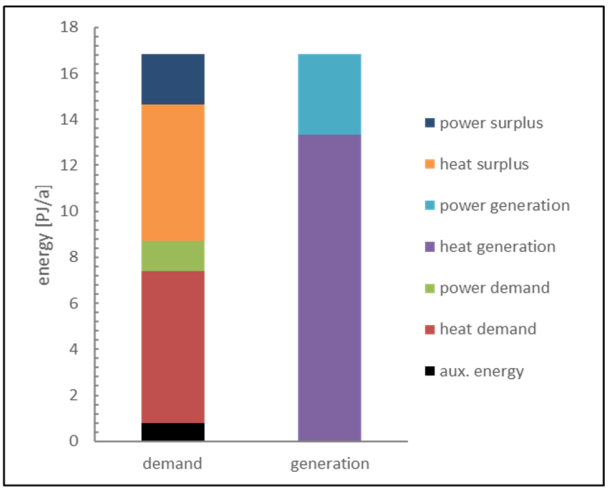

Figure 3: Energy balance of biorefinery plant

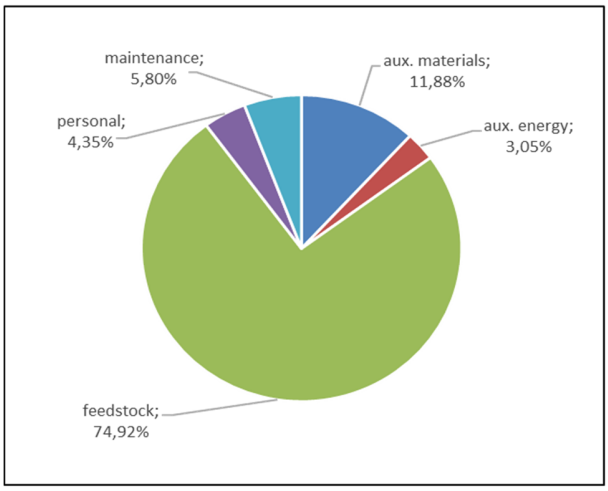

Figure 4: Share of costs

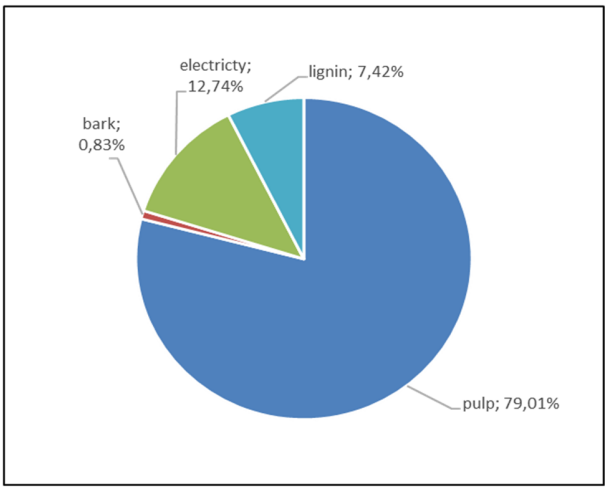

Figure 5: Share of revenues

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Part B: Value Chain Sustainability Assessment

1-platform (black liqour) biorefinery using wood chips for the production of Kraft pulp, Kraft lignin and energy

Conventional reference system

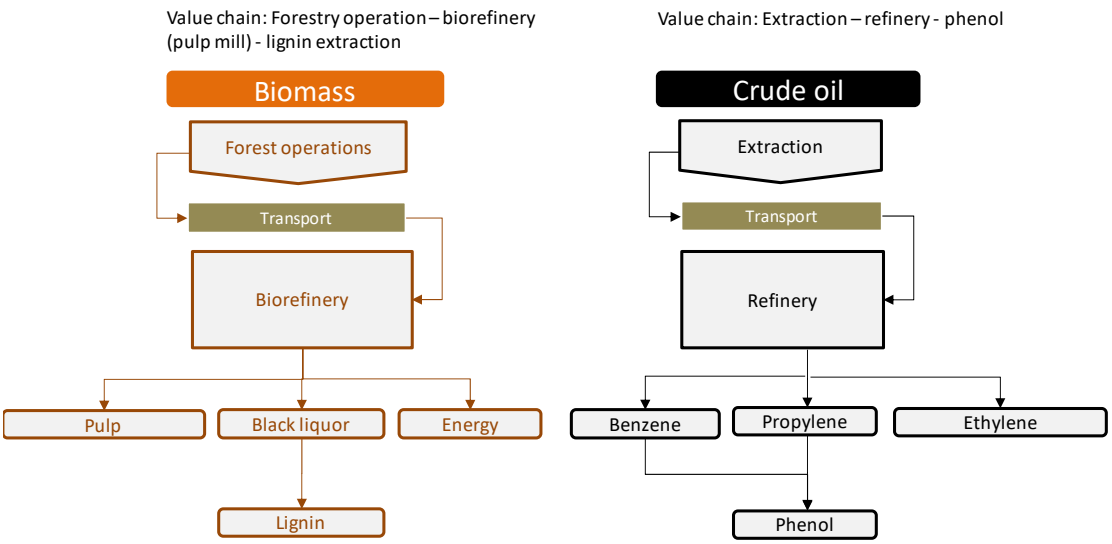

Figure 6: Biorefinery and reference system - value chain (cradle to gate)

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Key characteristics of biorefinery value chain

Greenhouse gas emissions		
Forestry	22,438	t CO_2eq.
Biorefinery	142,976	t CO_2eq.
Lignin extraction	23,488	t CO_2eq.
Reference system	309,882	t CO_2eq.
Savings	120,978	t CO_2eq.
Cumulated energy demand		
Fossil		
Forestry	956	TJ
Biorefinery	0	TJ
Lignin extraction	334	TJ
Reference system	8,240	TJ
Savings	6,948	TJ
Costs		
Annual costs	207	Mio €
Investment costs	11	Mio €
Revenues		
Specific revenues	633	€/t Reference flow

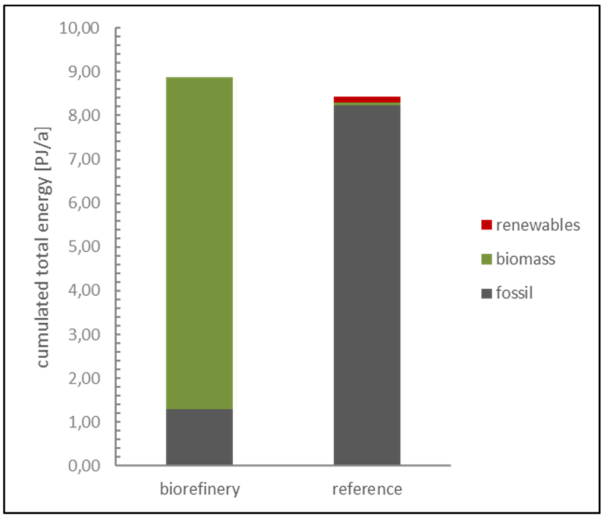

Figure 6: Cumulated energy demand of biorefinery compared to reference

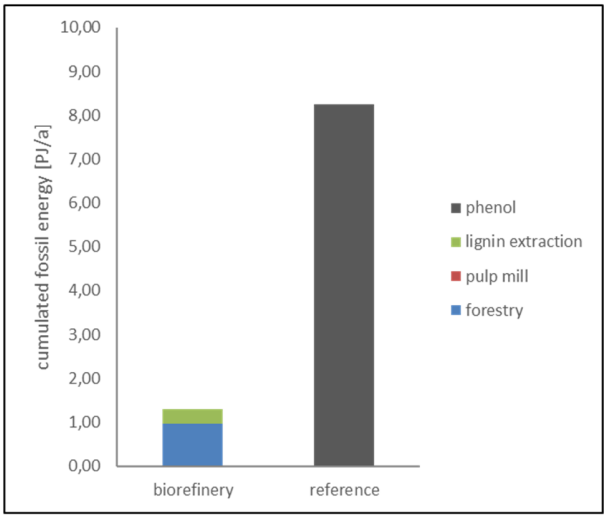

Figure 7: Cumulated fossil energy demand of biorefinery and reference

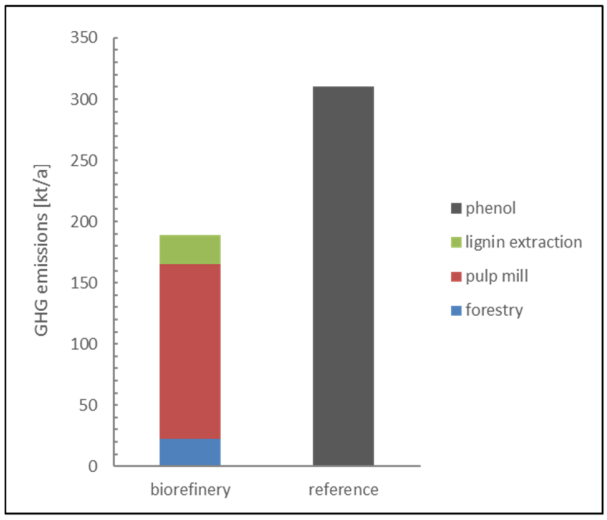

Figure 8: Greenhouse gas emissions of biorefinery and reference

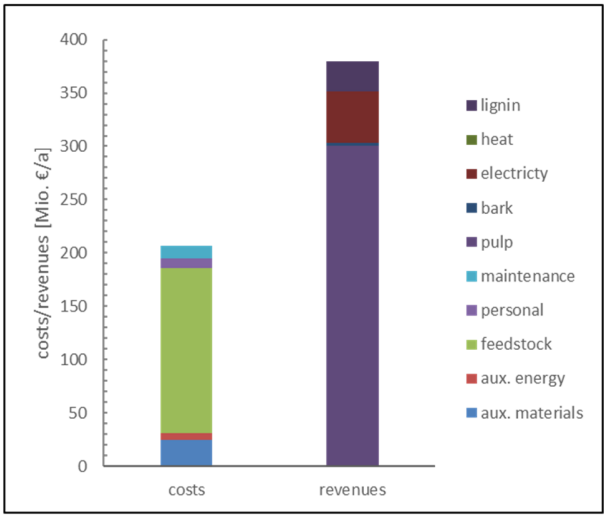

Figure: 9: Estimated cots and revenues of biorefinery plant

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