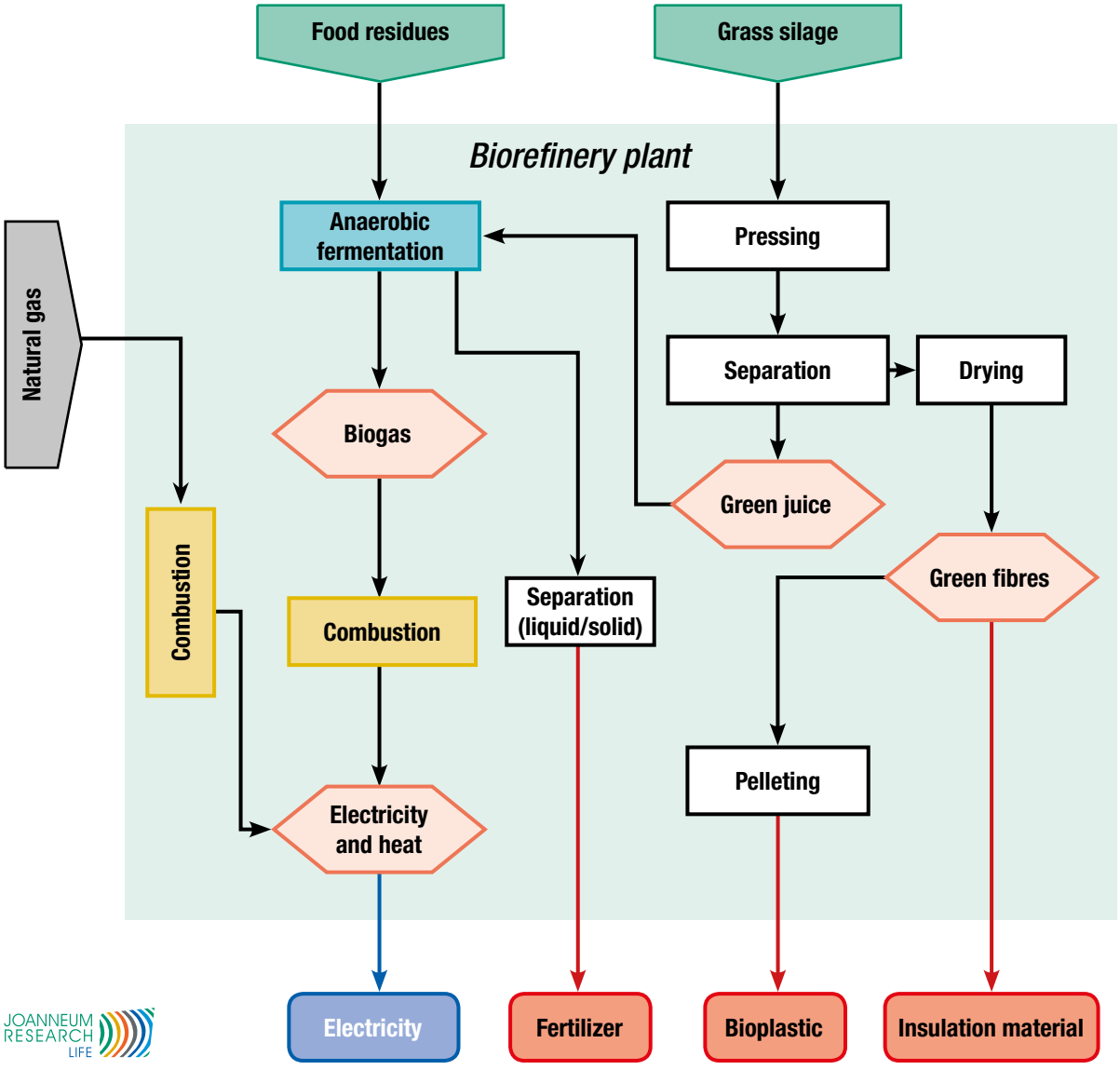
4-platform (biogas, green juice, green fibres, electricity&heat) biorefinery using grass silage and food residues for bioplastic, insulation material, fertilizer and electricity

Part A: Biorefinery plant

The "4-platform (biogas, green juice, green fibres, electricity&heat) biorefinery using grass silage and food residues for bioplastic, insulation material, fertilizer and electricity" converts grass to biogas and biobased products. The grass silage is mechanically pressed and then separated in a liquid phase ("Green juice") and solid phase ("Fibres"). After drying the fibres are used as insulation material or are further pelletized to be used as an ingredient for bioplastic. The green juice is used to produce biogas in an anaerobic fermentation. Food residues are used as an additional feedstock for the biogas fermentation.

The biogas is used in a CHP plant with an internal combustion engine to produce electricity and heat. The heat demand of the biorefinery is higher than the heat produced from biogas, so additionally natural gas is used to supply the heat. For electricity it is vice versa, the electricity production is higher than the electricity demand of the biorefinery. Therefore the excess electricity is sold to the grid. The residues of fermentation are separated in a solid and liquid fraction, which are used as fertilizer. This type of biorefinery is already realised in several countries.



JOANNEUM RESEARCH LIFE

IEA Bioenergy Task 42 Biorefining

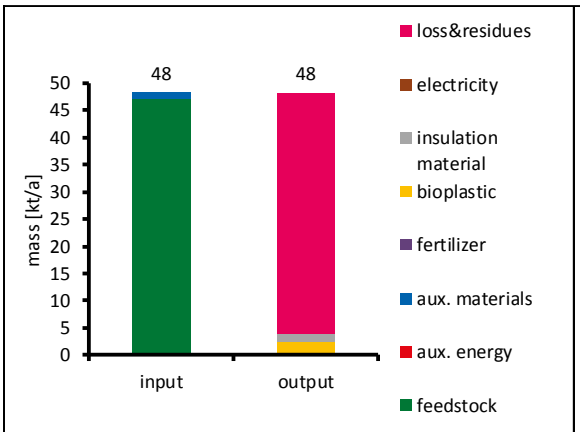
4-platform (biogas, green juice, green fibres, electricity&heat) biorefinery using grass silage and food residues for bioplastic, insulation material, fertilizer and electricity

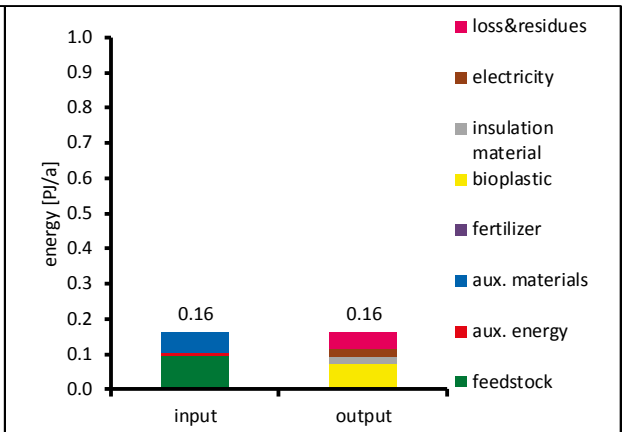
State of technology:	commercial 2013	Biorefinery Complexity Index (Products/Platform/Feedstock/Processes)	28 (3/7/8/10)
Country:	EU 27		
Main data sources:	VDI 6310, JOANNEUM RESEARCH		

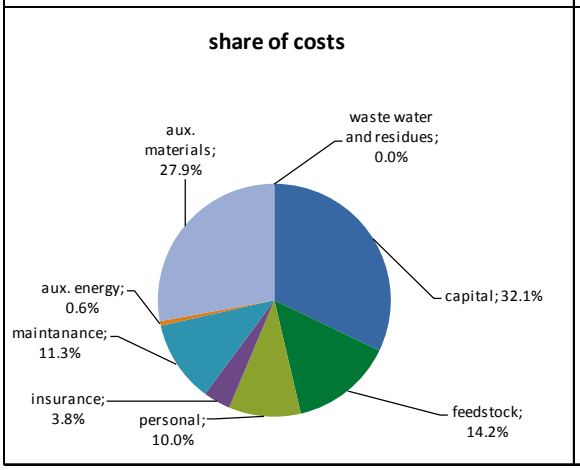
Products		**Auxiliaries (external)**	
fertilizer	0 [kt/a]	electricity	0 [PJ/a]
bioplastic	2.5 [kt/a]	heat	0.01 [PJ/a]
insulation material	1.4 [kt/a]		
electricity	0.02 [PJ/a]	polypropylen (PP)	1.3 [kt/a]
		urea	0.01 [kt/a]

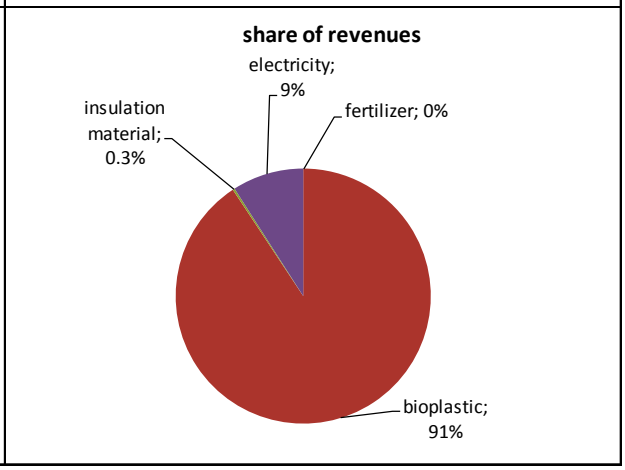
Feedstock	**[kt/a]**	**water content [%]**	**Costs**	
grass sillage	7	65.0%	investment costs	17 [Mio €]
food residues	40	80.0%	feedstock costs	14 [€/t]
			number of employees	10 [#]

Efficiencies	**mass**	**energy**
input to products	8%	72%
input to transportation biofuel	0%	0%



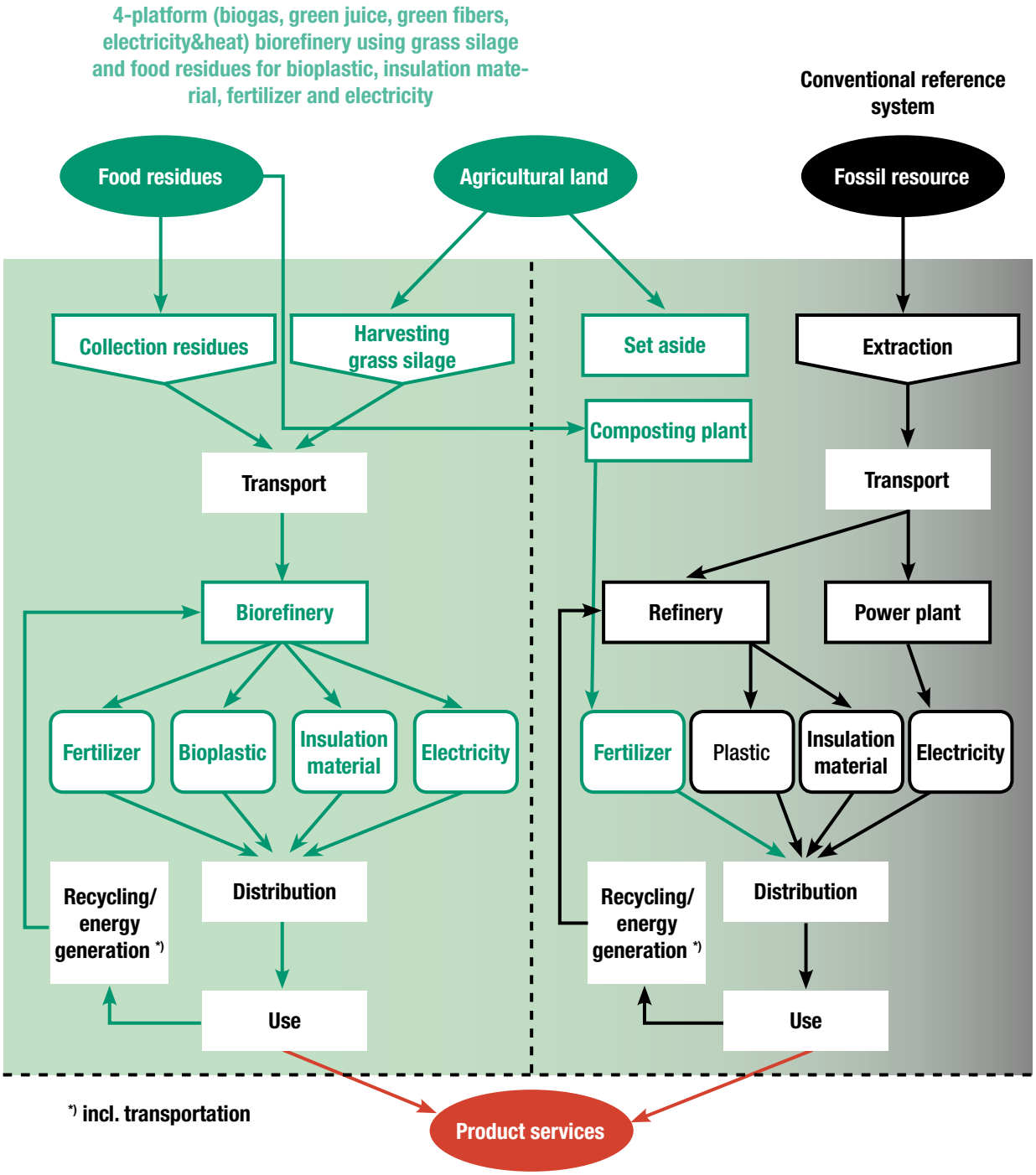






Part B: Value Chain Sustainability Assessment

The method of the sustainability assessment - economic and environmental – is given in Annex 1. The main assumptions and modelling choices are documented in Annex 2. The Annexes are available on the webpage of Task 42: www.iea-bioenergy.task42-biorefineries.com



Whole value chain

Greenhouse gas emissions		**range**	
biorefinery	5.5	(5.1 to 6.3)	[kt CO_2-eq/a]
reference system	21	(20 to 24)	[kt CO_2-eq/a]
saving	-74%	(-69% to -85%)	[%]
Cumulated energy demand			
fossil			
biorefinery	0.07	(0.07 to 0.08)	[PJ/a]
reference system	0.28	(0.26 to 0.32)	[PJ/a]
saving	-74%	(-69% to -85%)	[%]
total			
biorefinery	0.17	(0.16 to 0.2)	[PJ/a]
reference system	0.30	(0.28 to 0.34)	[PJ/a]
change	-42%	(-39% to -48%)	[%]
Agricultural area demand			
feedstock	700	(650 to 800)	[ha/a]
Costs			
annual costs	4.5	(4.2 to 5.2)	[Mio €/a]
specific costs	1,150	(1100 to 1300)	[€/t]
Revenues			
annual revenues	5.5	(5.1 to 6.3)	[Mio €/a]
specific revenues	1,410	(1300 to 1600)	[€/t]