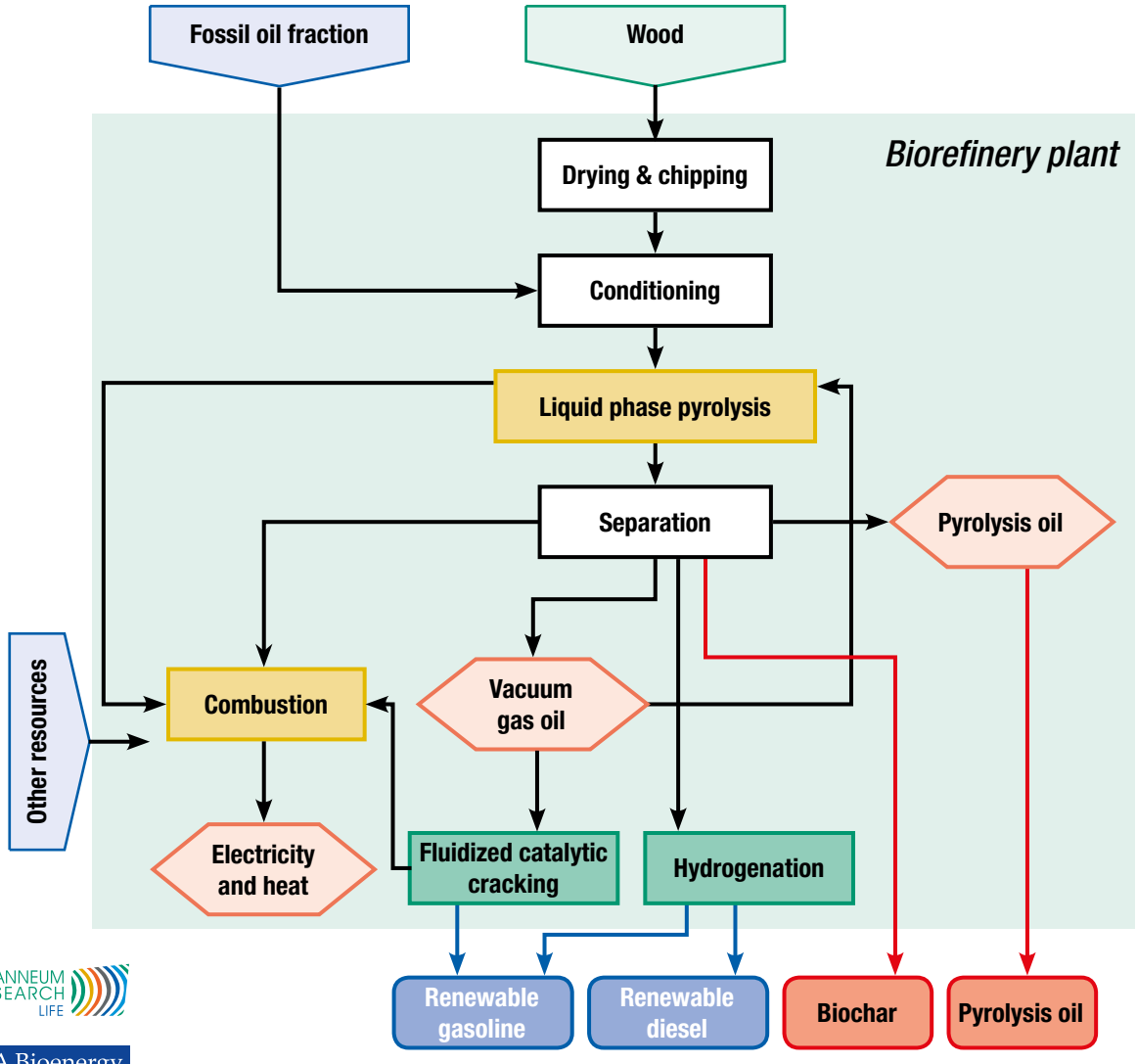
3-platform (vacuum gas oil, pyrolysis oil, electricity&heat) biorefinery using wood for renewable gasoline&diesel, biochar and pyrolysis oil

Part A: Biorefinery plant

The "3-platform (vacuum gas oil, pyrolysis oil, electricity&heat) biorefinery using wood for renewable gasoline&diesel, biochar and pyrolysis oil" converts wood via liquid phase pyrolysis into renewable gasoline and renewable diesel, biochar and pyrolysis oil. BDI - BioEnergy International AG (www.bdi-bioenergy.com/) is developing in cooperation with OMV (www.omv.com) the bioCRACK process, which produces transportation biofuel in diesel and gasoline quality from solid biomass. This process is currently being developed and practically tested in a pilot plant, which is integrated in the oil refinery of OMV in Schwechat/Austria. The bioCRACK process is based on liquid phase pyrolysis, where solid biomass is used in combination with fossil vacuum gas oil from the oil refinery. This process generates the following intermediate products: pyrolysis gas, pyrolysis oil, biochar, bioCRACK gasoil and kerosene, bioCRACK naphtha and vacuum gas oil. The pyrolysis gas and the biochar are used to provide the process heat, the additional heat requirement is supplied by natural gas and electricity is supplied by the grid. The vacuum gas oil is put into the fluidized catalytic cracking (FCC) process to produce renewable gasoline, low HC gas and a heavy fraction. The bioCRACK gasoil, kerosene, and naphtha are used in the hydrogenation to produce renewable gasoline and diesel. The analysis in the fact sheet is done for a possible first commercial plant using about 400,000 t_{DM} biomass input per year to produce about 47,000 t of renewable fuels (32,000 t renewable diesel and 15,000 t renewable gasoline). As the bioCRACK process uses beside biomass also vacuum gas oil from the conventional oil refinery, fossil and biogenic carbon is mixed in intermediates, co-products and final products. The results are shown only for the biofuels produced. The basic data for the production of biofuels with the bioCRACK process, FCC and hydrogenation were supplied by BDI - BioEnergy International AG.



JOANNEUM RESEARCH LIFE

IEA Bioenergy Task 42 Biorefining

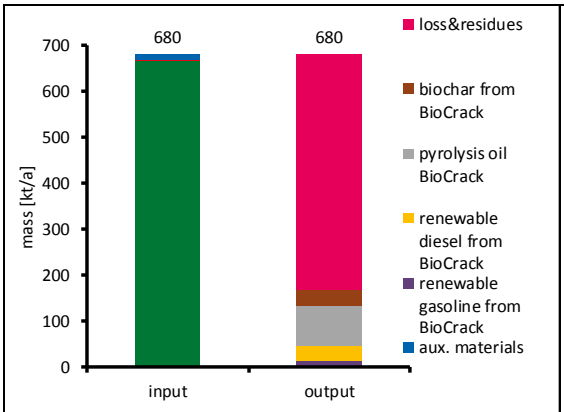
3-platform (vacuum gas oil, pyrolysis oil, electricity&heat) biorefinery using wood for renewable gasoline&diesel, biochar and pyrolysis oil

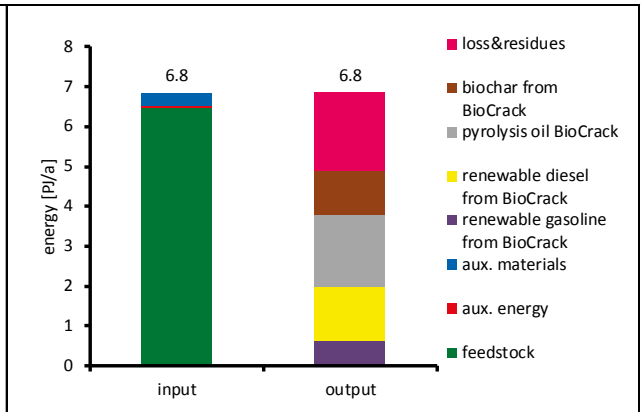
State of technology:	pilote scale	Biorefinery Complexity Index	29
Country:	Austria	(Platform/Feedstock/Products/Processes)	(4/1/11/13)
Main data sources:	BDI, JOANNEUM RESEARCH		

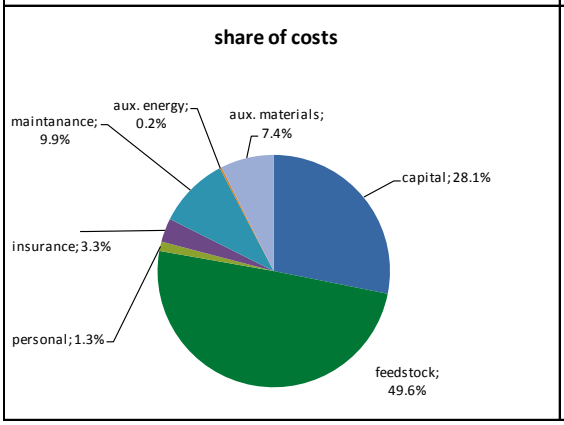
Products		**Auxiliaries (external)**	
renewable gasoline from BioCrack	15 [kt/a]	electricity	0.01 [PJ/a]
renewable diesel from BioCrack	32 [kt/a]	heat	0.00 [PJ/a]
pyrolysis oil BioCrack	87 [kt/a]	energy carriers	0.05 [PJ/a]
biochar from BioCrack	34 [kt/a]	n-Hexane	2.6 [kt/a]
		methanol	6.8 [kt/a]
		vacuum gas oil	0.7 [kt/a]
		hydrogen (natural gas)	0.4 [kt/a]
		nitrogen	1.4 [kt/a]

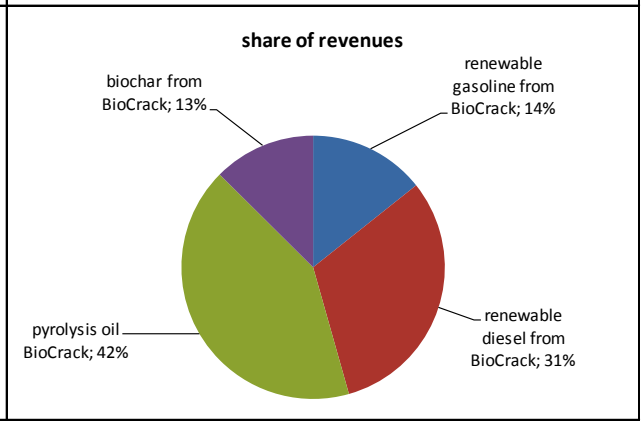
Feedstock	**[kt/a]**	**water [%]**	**Costs**	
wood 40%	667	40.0%	(estimated) investment costs	400 [Mio €]
			feedstock costs	90 [€/t]
			number of employees	35 [#]

Efficiencies	**mass**	**energy**
input to products	25%	72%
input to transportation biofuel	7%	29%



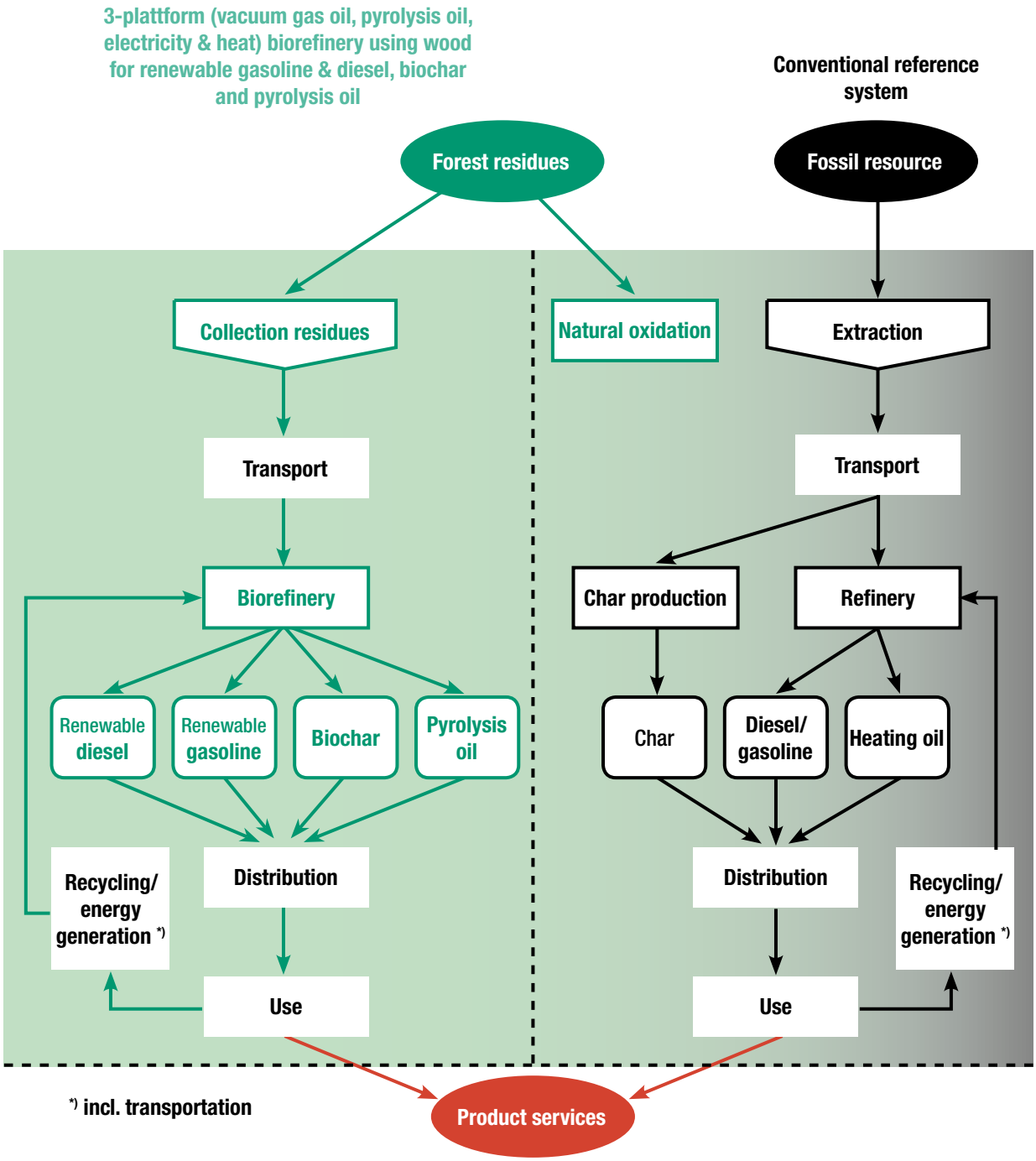






Part B: Value Chain Sustainability Assessment

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	66	(61 to 76)	[kt CO_2-eq/a]
reference system	480	(450 to 550)	[kt CO_2-eq/a]
saving	-86%	(-80% to -99%)	[%]
Cumulated energy demand			
fossil			
biorefinery	0.7	(0.62 to 0.76)	[PJ/a]
reference system	6.9	(6.4 to 7.9)	[PJ/a]
saving	-90%	(-84% to -100%)	[%]
total			
biorefinery	7.2	(6.7 to 8.2)	[PJ/a]
reference system	7.3	(6.8 to 8.3)	[PJ/a]
change	-1%	(-1% to -2%)	[%]
Agricultural area demand			
feedstock	0	(0 to 0)	[ha/a]
Costs			
annual costs	121	(110 to 140)	[Mio €/a]
specific costs	719	(670 to 830)	[€/t]
Revenues			
annual revenues	123	(110 to 140)	[Mio €/a]
specific revenues	734	(680 to 840)	[€/t]