Electronic Supplementary Material (ESI) for Green Chemistry
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Supplementary Information

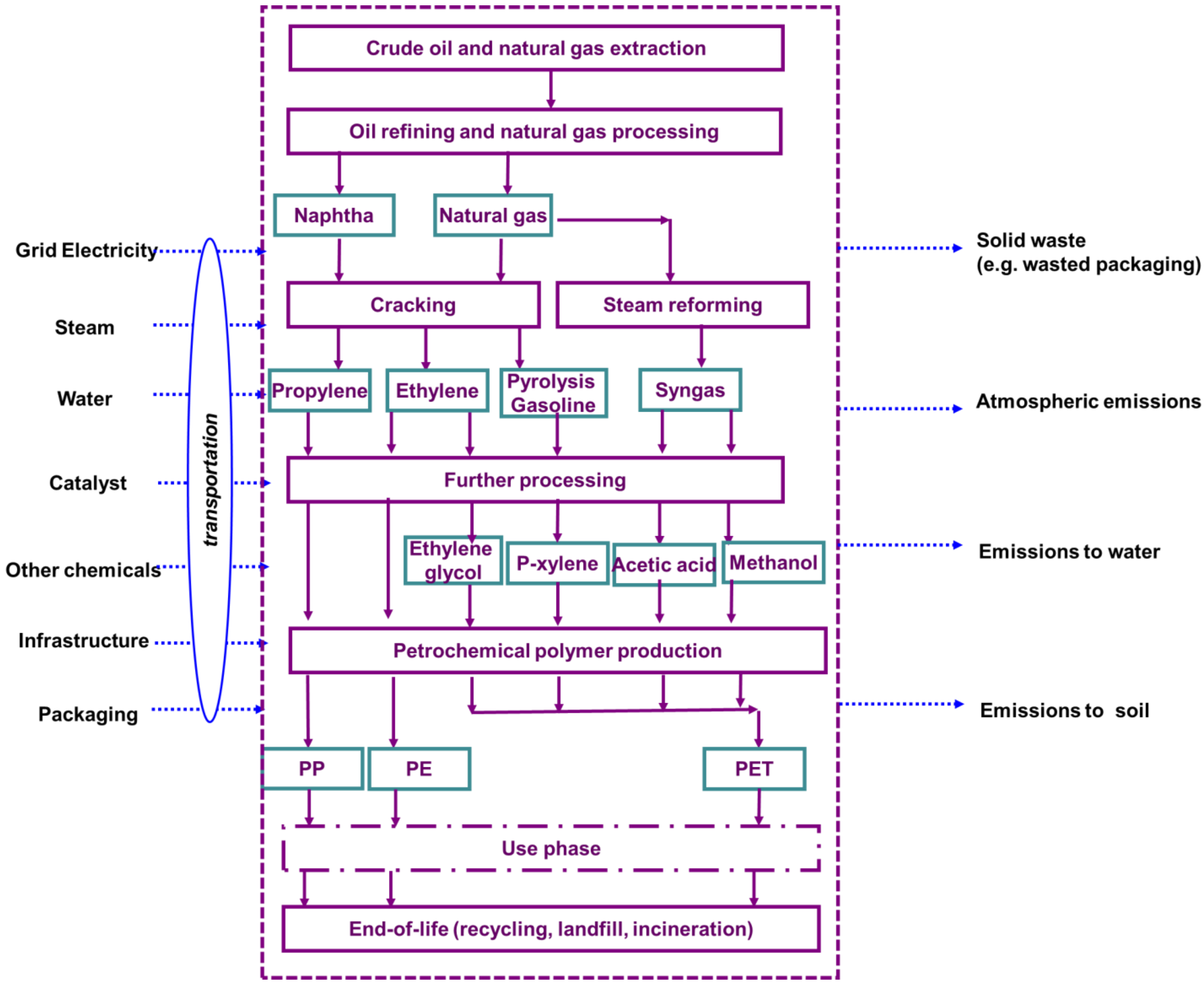

Fig S.1 Petrochemical polymer product system modelled (after PlasticsEurope)**.** Notes: product consumption and disposal in the UK were modelled; use phase was excluded from the system boundary

Table S.1 Key assumptions for PHBV scenarios

	Electricity for PHBV production	Steam for PHBV production	Electricity for glucose production	Steam for glucose production	Waste water treatment during PHBV production	Carbon utilization efficiency	Glucose feedstock	Glucose production process
Current production scenario	Fossil	Fossil	Fossil	Fossil	Aerobic	50%	Corn	Enzymatic hydrolysis
Process optimization - Energy supply system and waste water treatment								
Scenario 1	Renewable	Fossil	Fossil	Fossil	Aerobic	50%	Corn	Enzymatic hydrolysis
Scenario 2	Fossil	Renewable [a]	Fossil	Fossil	Aerobic	50%	Corn	Enzymatic hydrolysis
Scenario 3	Renewable	Renewable [a]	Fossil	Fossil	Aerobic	50%	Corn	Enzymatic hydrolysis
Scenario 4	Fossil	Fossil	Renewable [a]	Renewable [a]	Aerobic	50%	Corn	Enzymatic hydrolysis
Scenario 5	Renewable	Renewable	Renewable [a]	Renewable [a]	Aerobic	50%	Corn	Enzymatic hydrolysis
Scenario 6	Renewable	Renewable	Renewable	Renewable [a]	AD	50%	Corn	Enzymatic hydrolysis
Process optimization - Substrate carbon utilization efficiency								
Scenario 7	Fossil	Fossil	Fossil	Fossil	Aerobic	60%	Corn	Enzymatic hydrolysis
Scenario 8	Fossil	Fossil	Fossil	Fossil	Aerobic	70%	Corn	Enzymatic hydrolysis
Scenario 9	Fossil	Fossil	Fossil	Fossil	Aerobic	80%	Corn	Enzymatic hydrolysis
Scenario 10	Renewable [a]	Renewable [a]	Renewable [a]	Renewable [a]	Aerobic	60%	Corn	Enzymatic hydrolysis
Scenario 11	Renewable [a]	Renewable [a]	Renewable [a]	Renewable [a]	Aerobic	70%	Corn	Enzymatic hydrolysis
Scenario 12	Renewable [a]	Renewable [a]	Renewable [a]	Renewable [a]	Aerobic	80%	Corn	Enzymatic hydrolysis
Process-optimization - Lignocellulosic glucose feedstock								
Scenario 13	Fossil	Fossil	Renewable [a]	Renewable [a]	Aerobic	50%	Corn stover	Enzymatic hydrolysis
Scenario 14	Renewable [a]	Renewable [a]	Renewable [a]	Renewable [a]	Aerobic	50%	Corn stover	Enzymatic hydrolysis
Scenario 15	Renewable [a]	Renewable [a]	Renewable [a]	Renewable [a]	Aerobic	60%	Corn stover	Enzymatic hydrolysis
Scenario 16	Renewable [a]	Renewable [a]	Renewable [a]	Renewable [a]	Aerobic	70%	Corn stover	Enzymatic hydrolysis
Scenario 17	Renewable [a]	Renewable [a]	Renewable [a]	Renewable [a]	Aerobic	80%	Corn stover	Enzymatic hydrolysis
Scenario 18	Fossil	Fossil	Renewable [a]	Renewable [a]	Aerobic	50%	Softwood chips	Dilute acid hydrolysis
Scenario 19	Renewable [a]	Renewable [a]	Renewable [a]	Renewable [a]	Aerobic	50%	Softwood chips	Dilute acid hydrolysis
Scenario 20	Renewable [a]	Renewable [a]	Renewable [a]	Renewable [a]	Aerobic	60%	Softwood chips	Dilute acid hydrolysis
Scenario 21	Renewable [a]	Renewable [a]	Renewable [a]	Renewable [a]	Aerobic	70%	Softwood chips	Dilute acid hydrolysis
Scenario 22	Renewable [a]	Renewable [a]	Renewable [a]	Renewable [a]	Aerobic	80%	Softwood chips	Dilute acid hydrolysis

a. *Bioenergy was assumed to be generated from wood biomass combustion in a CHP system (Ecoinvent database v 2.2)*

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Table S.2 Characterized fossil fuel profiles (MJ surplus energy) for PHBV vs. petrochemical polymers (unit 1 kg granulate, method Eco-indicator 99 H V2.08)

PHBV (MJ surplus energy/kg polymer)		**Cradle-to-factory gate**	**Cradle-to-gate life cycles**		
			AD [a]	**Composting**	**EfW [b]**
Current		6.69	6.03	6.58	5.82
Energy supply system and waste water treatment	Scenario 1	6.10	5.44	5.99	5.23
	Scenario 2	6.33	5.67	6.22	5.47
	Scenario 3	5.74	5.09	5.63	4.88
	Scenario 4	6.12	5.46	6.01	5.26
	Scenario 5	5.17	4.52	5.06	4.31
	Scenario 6	4.96	4.30	4.85	4.10
Carbon utilization efficiency	Scenario 7	5.56	4.90	5.45	4.69
	Scenario 8	4.98	4.33	4.87	4.12
	Scenario 9	4.55	3.89	4.44	3.69
	Scenario 10	4.17	3.51	4.06	3.30
	Scenario 11	3.66	3.00	3.55	2.79
	Scenario 12	3.27	2.62	3.16	2.41
Lignocellulosic glucose feedstock	Scenario 13	7.84	7.19	7.73	6.98
	Scenario 14	6.90	6.24	6.79	6.03
	Scenario 15	5.51	4.86	5.40	4.65
	Scenario 16	4.81	4.15	4.70	3.95
	Scenario 17	4.28	3.63	4.17	3.42
	Scenario 18	2.29	1.63	2.18	1.42
	Scenario 19	1.34	0.69	1.23	0.48
	Scenario 20	1.18	0.52	1.07	0.31
	Scenario 21	1.09	0.44	0.98	0.23
	Scenario 22	1.03	0.37	0.92	0.16
Petrochemicals (MJ surplus energy/kg polymer)		**Cradle-to-factory-gate**	**Cradle-to-grave life cycles**		
			EfW [b]	**Landfill**	**Recycling**
PP		9.34	7.81	9.53	0.52
PET		8.72	7.77	8.91	0.32
LDPE		9.25	7.16	9.44	0.52
HDPE		9.45	7.36	9.63	0.52

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a. *AD=anaerobic digestion*
b. *Incineration with energy recovery (termed Energy-from-Waste (EfW)*