

A protocol for the definition of supply chains in product social life cycle assessment: application to bioelectricity

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Supplementary material

Social life cycle inventory (S-LCI) results of the bioelectricity system

Figures S1-S12 show the S-LCI results of the additional plants resulting from the application of the protocol.

Refractory fireclay production, 1 kg (UA)			Steel, low-alloyed, hot rolled, production, 1 kg (DE)		
Working hours	$9.44 \cdot 10^{-3}$ h	(UA)	Working hours	$7.42 \cdot 10^{-3}$ h	(DE)
Clay	1.20 kg	(DE)	Ferrochromium	$3.29 \cdot 10^{-2}$ kg	(ZA)
Natural gas	$7.69 \cdot 10^{-2}$ \$	(RU)	Pig iron	0.9 kg	(61% BR, 39% RU)
Electricity	$1.67 \cdot 10^{-2}$ \$	(UA)	Natural gas	$1.47 \cdot 10^{-2}$ \$	(NO)
			Electricity	$2.77 \cdot 10^{-2}$ \$	(DE)

Concrete production, 1 kg (PT)			Steel, low-alloyed, hot rolled, production, 1 kg (FR)		
Working hours	$1.17 \cdot 10^{-3}$ h	(PT)	Working hours	$7.91 \cdot 10^{-3}$ h	(FR)
Cement	$8.30 \cdot 10^{-2}$ kg	(PT)	Ferrochromium	$3.29 \cdot 10^{-2}$ kg	(58% ZA, 42% KZ)
Gravel	$2.10 \cdot 10^{-2}$ \$	(PT)	Pig iron	0.9 kg	(86% RU, 14% BR)
Sand	$6 \cdot 10^{-3}$ \$	(PT)	Natural gas	$4 \cdot 10^{-4}$ \$	(NO)
Natural gas	$9.21 \cdot 10^{-6}$ \$	(DZ)	Electricity	$2.20 \cdot 10^{-2}$ \$	(FR)
Electricity	$2.91 \cdot 10^{-4}$ \$	(PT)			

Fig. S1. S-LCI results of the main blocks regarding boiler production.

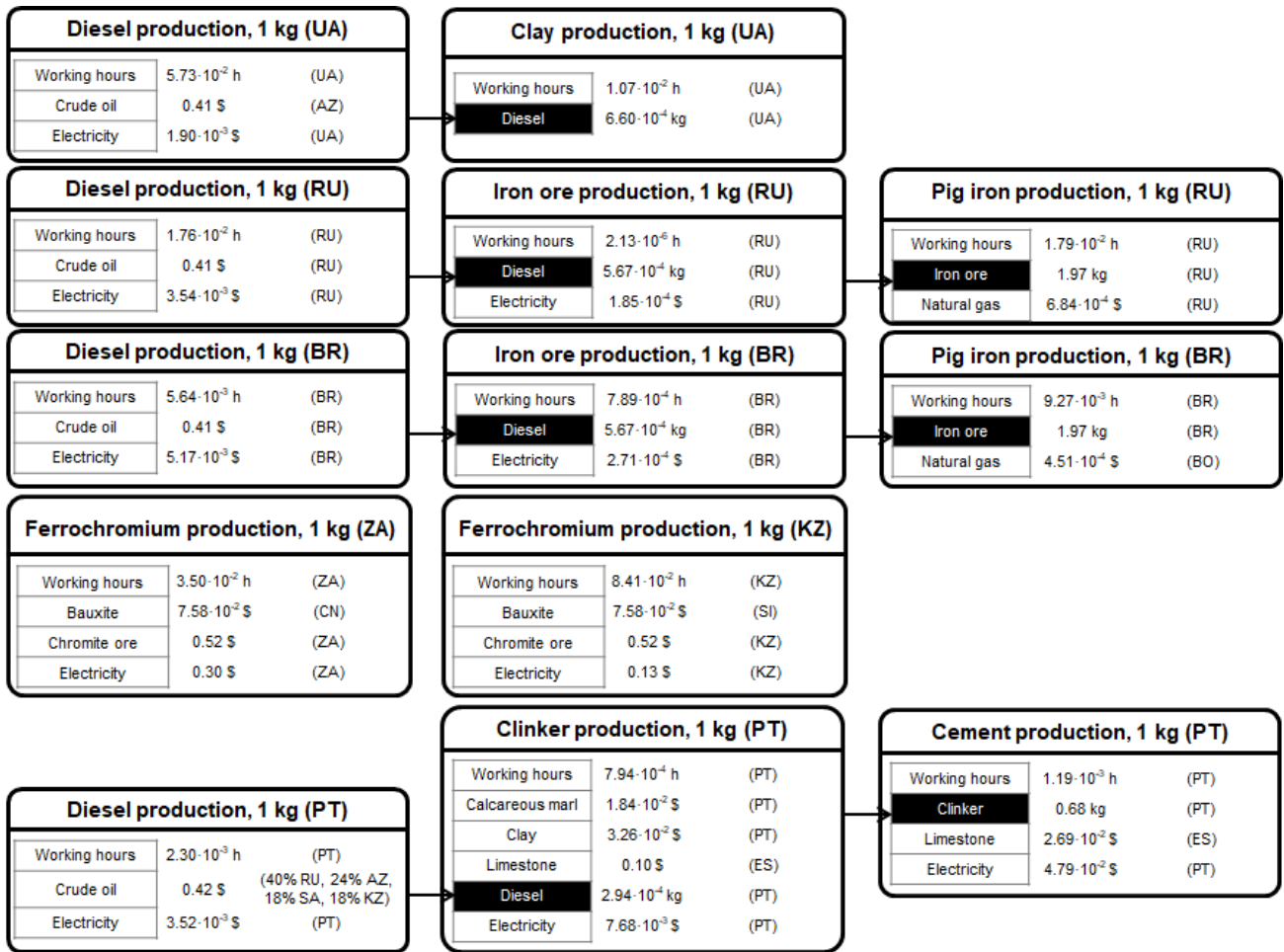


Fig. S2. S-LCI results of the background blocks regarding boiler production.

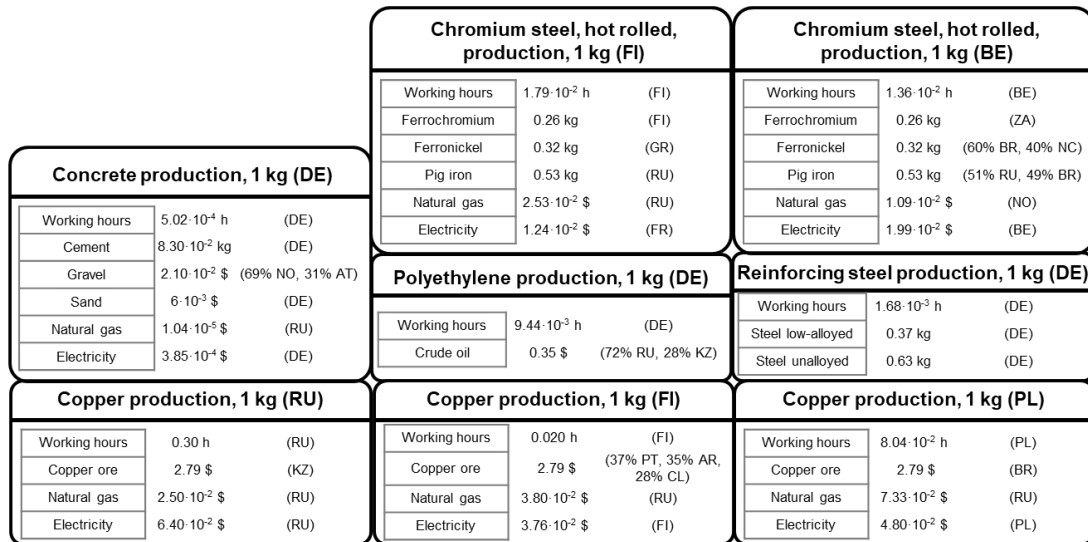


Fig. S3. S-LCI results of the main blocks regarding turbine production.

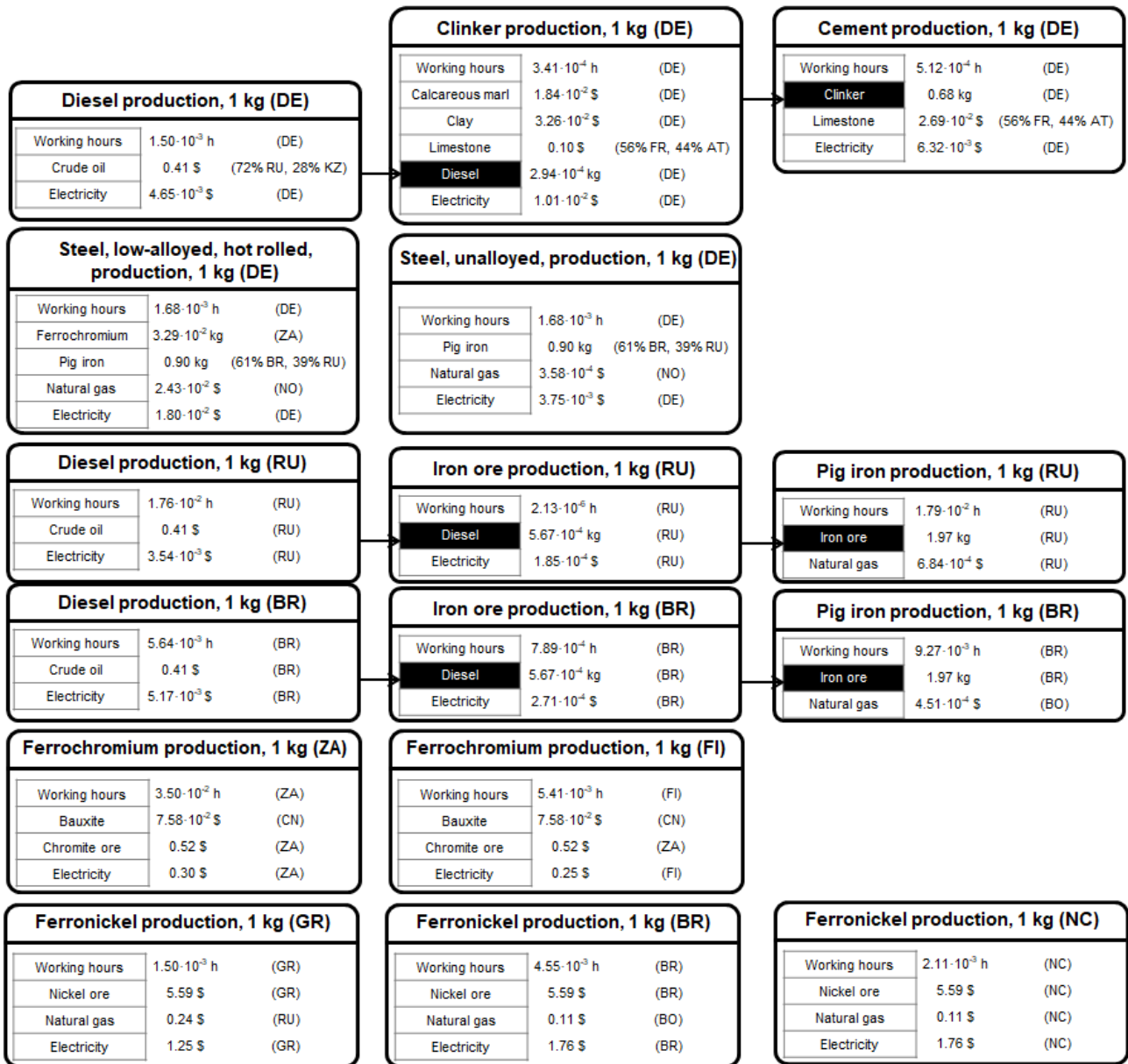


Fig. S4. S-LCI results of the background blocks regarding turbine production.

Cast iron production, 1 kg (AT)			Chromium steel, hot rolled, production, 1 kg (FI)			Chromium steel, hot rolled, production, 1 kg (BE)		
Working hours	5.96 · 10 ⁻³ h	(AT)	Working hours	1.79 · 10 ⁻² h	(FI)	Working hours	1.36 · 10 ⁻² h	(BE)
Pig iron	0.72 kg	(61% RU, 39% UA)	Ferchromium	0.26 kg	(FI)	Ferchromium	0.26 kg	(ZA)
Natural gas	1.00 · 10 ⁻² \$	(RU)	Ferronickel	0.32 kg	(GR)	Ferronickel	0.32 kg	(60% BR, 40% NC)
Electricity	4.76 · 10 ⁻² \$	(AT)	Pig iron	0.53 kg	(RU)	Pig iron	0.53 kg	(51% RU, 49% BR)
Steel, unalloyed, production, 1 kg (SK)			Natural gas	2.53 · 10 ⁻² \$	(RU)	Natural gas	1.09 · 10 ⁻² \$	(NO)
Working hours	1.61 · 10 ⁻² h	(SK)	Electricity	1.24 · 10 ⁻² \$	(FR)	Electricity	1.99 · 10 ⁻² \$	(BE)
Pig iron	0.90 kg	(61% RU, 39% CZ)	Chromium steel, hot rolled, production, 1 kg (CN)			Chromium steel, hot rolled, production, 1 kg (US)		
Natural gas	3.40 · 10 ⁻⁴ \$	(51% NO, 49% RU)	Working hours	8.10 · 10 ⁻² h	(CN)	Working hours	1.87 · 10 ⁻² h	(US)
Electricity	2.76 · 10 ⁻³ \$	(SK)	Ferchromium	0.26 kg	(66% ZA, 34% KZ)	Ferchromium	0.26 kg	(76% , 24% KZ)
Synthetic rubber production, 1 kg (DE)			Ferronickel	0.32 kg	(ID)	Ferronickel	0.32 kg	(61% BR, 49% GT)
Working hours	1.92 · 10 ⁻² h	(DE)	Pig iron	0.53 kg	(CN)	Pig iron	0.53 kg	(RU)
Carbon black	0.37 kg	(DE)	Natural gas	7.15 · 10 ⁻³ \$	(TM)	Natural gas	2.00 · 10 ⁻² \$	(CA)
Polyethylene	0.25 kg	(DE)	Electricity	1.85 · 10 ⁻² \$	(CN)	Electricity	1.70 · 10 ⁻² \$	(US)
Polypropylene	6.28 · 10 ⁻² kg	(DE)						
Zinc ore	4.83 · 10 ⁻² \$	(38% SE, 34% AU, 28% BF)						
Electricity	0.12 \$	(DE)						

Fig. S5. S-LCI results of the main blocks regarding forwarder production.

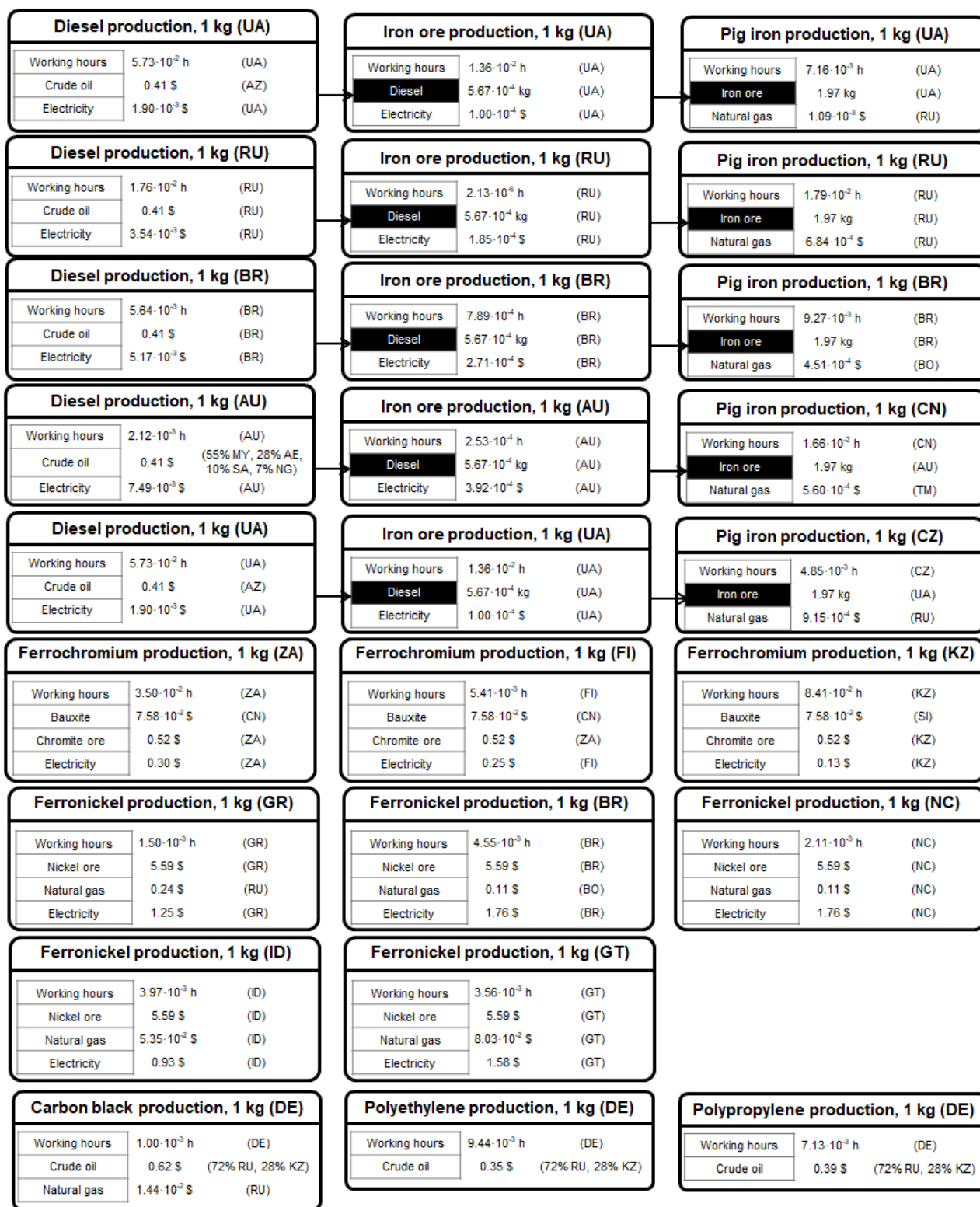


Fig. S6. S-LCI results of the background blocks regarding forwarder production.

Diesel production, 1 kg (FR)		n-olefins production, 1 kg (FR)		Synthetic rubber production, 1 kg (FR)	
Working hours	1.05 · 10 ⁻² h (FR)	Working hours	7.14 · 10 ⁻⁴ h (FR)	Working hours	1.48 · 10 ⁻² h (FR)
Crude oil	0.41 \$ (31% RU, 29% KZ, 21% SA, 19% IR)	Ethylene	0.63 kg (FR)	Carbon black	0.37 kg (45% DE, 29% RU, 26% NL)
Electricity	2.76 · 10 ⁻³ \$ (RU)	Paraffin	0.35 kg (MY, CN)	Polyethylene	0.25 kg (47% BE, 34% DE, 19% NL)
		Natural gas	8.95 · 10 ⁻² \$ (NO)	Polypropylene	6.28 · 10 ⁻² kg (FR)
		Electricity	2.23 · 10 ⁻² \$ (FR)	Zinc ore	4.83 · 10 ⁻² \$ (33% SE, 41% AU, 26% BF)
				Electricity	7.47 · 10 ⁻² \$ (FR)

Fig. S7. S-LCI results of the main blocks regarding lubricating oil production.

Ethylene production, 1 kg (FR)		Paraffin production, 1 kg (MY)		Paraffin production, 1 kg (CN)	
Working hours	8.67 · 10 ⁻⁴ h (FR)	Working hours	6.04 · 10 ⁻³ h (MY)	Working hours	2.09 · 10 ⁻² h (CN)
Crude oil	0.36 \$ (31% RU, 29% KZ, 21% SA, 19% IR)	Crude oil	0.41 \$ (45% SA, 26% AE, 16% VE, 13% GA)	Crude oil	0.41 \$ (26% RU, 23% SA, 22% AO, 15% IQ, 14% OM)
		Natural gas	1.67 · 10 ⁻² \$ (ID)	Natural gas	1.30 · 10 ⁻² \$ (TM)
		Electricity	1.55 · 10 ⁻³ \$ (MY)	Electricity	2.94 · 10 ⁻³ \$ (CN)
Carbon black production, 1 kg (DE)		Carbon black production, 1 kg (RU)		Carbon black production, 1 kg (NL)	
Working hours	1.00 · 10 ⁻³ h (DE)	Working hours	2.23 · 10 ⁻² h (RU)	Working hours	1.04 · 10 ⁻³ h (NL)
Crude oil	0.62 \$ (72% RU, 28% KZ)	Crude oil	0.62 \$ (RU)	Crude oil	0.62 \$ (56% RU, 44% NO)
Natural gas	1.44 · 10 ⁻² \$ (RU)	Natural gas	8.62 · 10 ⁻² \$ (RU)	Natural gas	1.27 · 10 ⁻² \$ (NO)
Polyethylene production, 1 kg (BE)		Polyethylene production, 1 kg (DE)		Polyethylene production, 1 kg (NL)	
Working hours	6.51 · 10 ⁻³ h (BE)	Working hours	9.44 · 10 ⁻³ h (DE)	Working hours	9.15 · 10 ⁻³ h (NL)
Crude oil	0.35 \$ (61% RU, 39% NO)	Crude oil	0.35 \$ (72% RU, 28% KZ)	Crude oil	0.35 \$ (56% RU, 44% NO)
Polypropylene production, 1 kg (FR)					
Working hours	7.29 · 10 ⁻³ h (FR)				
Crude oil	0.39 \$ (31% RU, 29% KZ, 21% SA, 19% IR)				

Fig. S8. S-LCI results of the background blocks regarding lubricating oil production.