life cycle assessment (LCA)
PROOX GmbH

SANITARY PRODUCTS

Bilanzierung & Bericht

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1 Introduction

1.1 General

This life cycle report documents the life cycle assessment for PROOX GmbH's restroom accessories for the manufacturing phase (modules A1-A3). The aim is to present the ecological and energy performance for the entire manufacturing phase of the products.

Seven product categories, each with three different surface coatings, were assessed (a total of 21 products). In order to present the report and its findings as clearly as possible, the results were grouped into two different product groups. One product group covers products made exclusively from stainless steel components. This product group is referred to below as "stainless steel products." The second product group consists of stainless steel components and additional plastic components. These products are referred to below as "mixed products." The results refer to the average of all products in this product group and apply to 1 kilogram of finished product (declared unit).

1.2 The company – PROOX GmbH

PROOX GmbH is an Austrian manufacturer of high-quality restroom accessories based in Fußach (Vorarlberg). The company was founded in 2010 by Armin Degasperi.

The company positions itself in the premium segment for semi-public sanitary facilities and targets its product portfolio specifically at administrative and other semi-public projects. Typical references include government projects, administrative buildings, and generally commercial architecture.

On the product side, PROOX manufactures and distributes a range of restroom accessories and systems, including surface-mounted products (Line ONE), such as electronic and mechanical soap dispensers, paper towel dispensers, hand dryers, and toilet accessories, as well as a line of concealed solutions (Line ZERO).

The company emphasizes design, durable materials (e.g., stainless steel), and hygienic functionality tailored for public restroom environments. PROOX maintains an online platform offering CAD data, specification texts, 360° views, and an online shop.

In terms of the market, PROOX is strongly export-oriented. When it comes to export figures, company directories cite figures of up to approx. 72%. The company sells its product range in export markets either directly (Germany, Sweden, Netherlands, etc.) or via distribution partners (Denmark, Switzerland, Norway, Finland, Portugal, etc.). The four markets with the highest sales are Germany, Austria, Denmark, and Switzerland.

The company communicates directly with the most important decision-making groups. These are architects and engineering firms for sanitary planning.

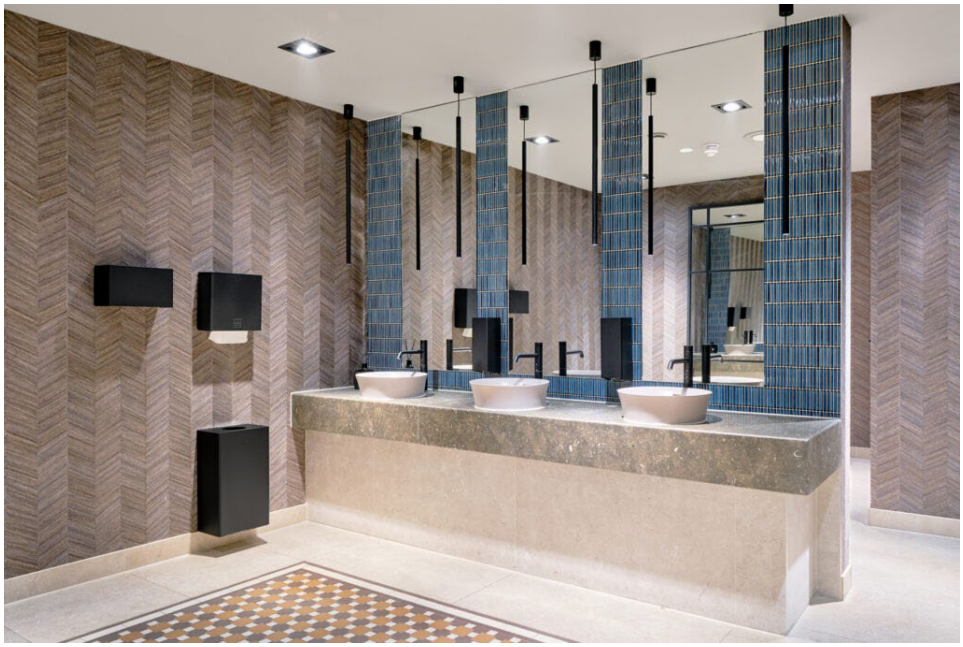

Figure1: PROOX GmbH

2 Products

PROOX products are divided into two lines. The ZERO line covers all concealed and behind-mirror solutions, and the ONE line includes all products that are surface-mounted.
In this life cycle assessment (LCA), we focus exclusively on the ONE line (surface-mounted), as this product range accounts for approximately 85% of sales.
This line includes products made exclusively from stainless steel as well as products that, in addition to a stainless steel housing, also contain other components such as containers for soap dispensers or toilet brushes (made of plastic).
There are also products that are electrically operated, such as hand dryers or electric soap dispensers. These electrically operated products are also not included in the life cycle assessment.

For the purposes of the assessment, the products were divided into the following two product groups and assessed separately:

1. Stainless steel products: these are products made exclusively from stainless steel.
   This group includes the following products
   - Waste bins
   - Paper towel dispensers
   - Toilet roll holders

2. Mixed products: these are products that, in addition to a stainless steel housing, also have other components with a small proportion of plastic.
   This group includes the following products
   - Soap and disinfectant dispensers
   - Toilet brush sets
   - Hygiene waste bins

All products are available in different finishes and coatings. This wide range of coatings can be reduced to three basic types:

1. Stainless steel surface without additional coating
2. Stainless steel surface with powder coating (color coatings such as black or white)
3. Stainless steel surface with PVD coating (coatings in metal look, e.g., brass, copper)

Each product was assessed with all three coatings in order to compare the results.

2.1 Stainless steel products

As PROOX manufactures a wide range of products, two representative products were selected from all stainless steel products for the balancing, which were then assessed individually. An average was then calculated from the results for these products. In addition, the maximum deviations from the average were also indicated in the results.

The stainless steel products included in the assessment are as follows:

PU-100 paper towel dispenser:

Paper towel dispenser for wall mounting. Stainless steel. Front 1.5 mm material thickness. Perforated fill level indicator with 4 mm holes. Lock not visible from the outside. Integrated soft-slide box for easy paper removal. Capacity approx. 550 pieces for Z-fold paper towels. Suitable for paper towels with a length of approx. 220-250 mm and a folded width of approx. 95-120 mm.

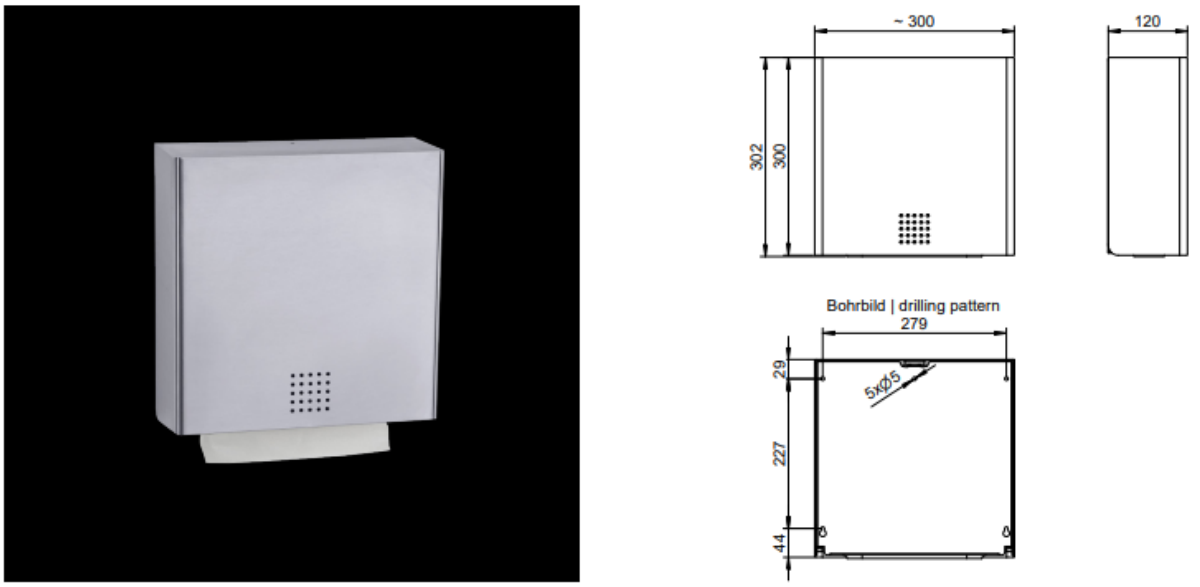

Figure2: PU-100 paper towel dispenser

Waste bin PU-200:

Waste bin for wall mounting. Stainless steel. Front 1.5 mm material thickness. Perforated design surface with 4 mm holes. Integrated bag holder. Capacity approx. 31 liters.

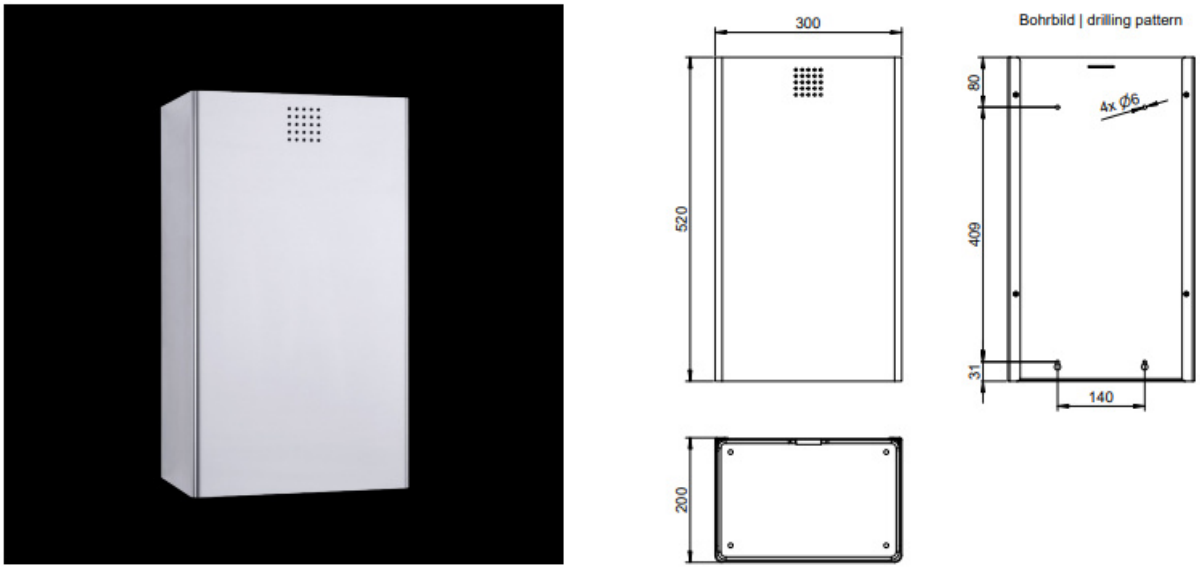

Figure3: Waste bin PU-200

2.2 Mixed products

Five representative products were selected for the assessment. These products were then assessed individually and the results were averaged. In addition, the maximum deviations from the average were indicated in the results.

The mixed products included in the assessment are as follows:

PU-140 cream soap dispenser:

Cream soap dispenser for wall mounting. Stainless steel. Front 1.5 mm material thickness. Perforated design surface with 4 mm holes. Lock not visible from the outside. Stainless steel push lever and high-quality pump with suction effect. Refill container with removable lid for cleaning.
Capacity approx. 1.4 liters. Approx. 1.5 ml per stroke.

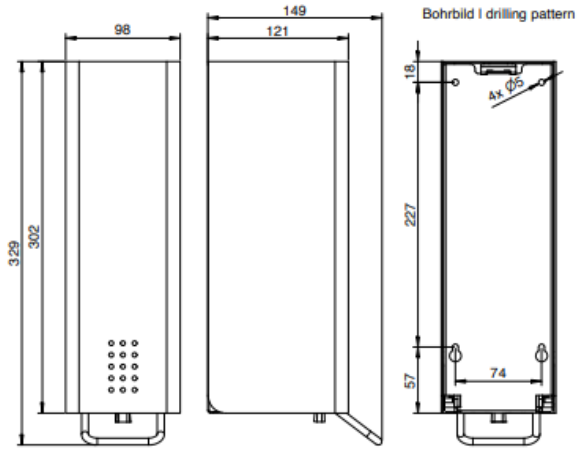

Figure4: Cream soap dispenser PU-140

Cream soap dispenser PU-141:

Cream soap dispenser for wall mounting. Stainless steel. Front 1.5 mm material thickness. Perforated design surface with 4 mm holes. Lock not visible from the outside. Stainless steel push lever and high-quality pump with suction effect. Refill container with removable lid for cleaning.
Capacity approx. 0.5 liters. Approx. 1.5 ml per pump.

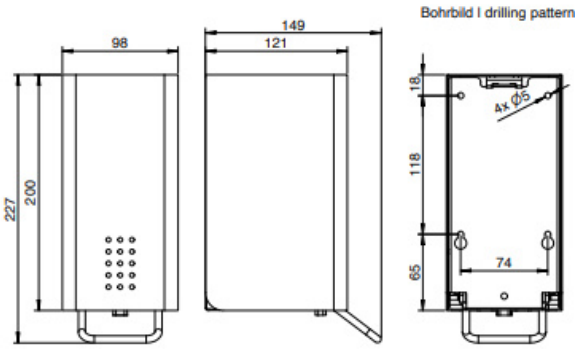

Figure5: Cream soap dispenser PU-141

Hygiene waste bin with integrated hygiene bag dispenser PU-400:

Hygiene waste bin with integrated hygiene bag dispenser for wall mounting.
Stainless steel 1.5 mm material thickness. Perforated design surface with 4 mm holes. Internal plastic container with a capacity of approx. 4 liters for easy cleaning. Self-closing mechanism. Integrated hygiene bag dispenser for hygiene bag boxes up to a maximum of 132x87x20 mm

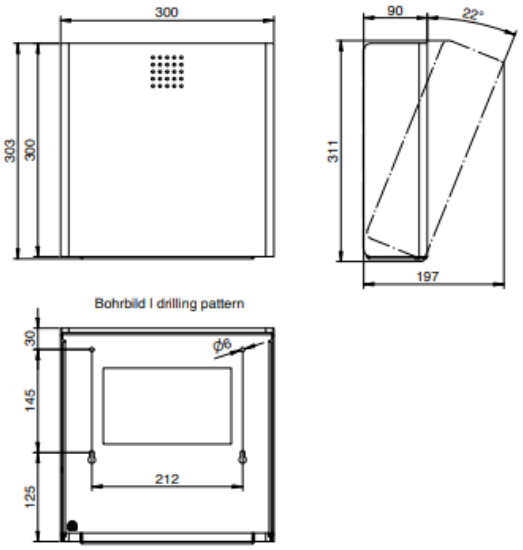

Figure6: Hygiene waste bin PU-400

Toilet brush set PU-500:

Toilet brush set for wall mounting. Stainless steel. Front 1.5 mm material thickness and closed all around. Perforated design surface with 4 mm holes. Handle made of brushed stainless steel ( ). Toilet brush head with functional shape. Removable plastic insert for optimal cleaning.

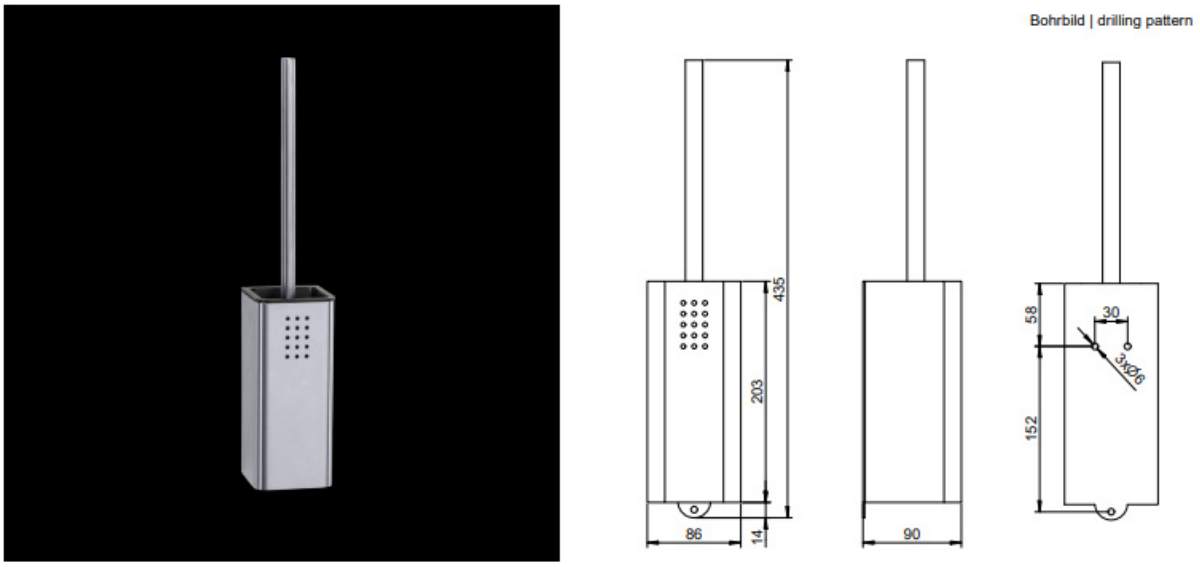

Figure7: Toilet brush set PU-500

Toilet brush set PU-505:

Round toilet brush set for wall mounting. Stainless steel. Housing with 2 mm material thickness and closed all around. Slim, long handle made of brushed stainless steel with cover. Black replaceable toilet brush head with functional shape. Free-hanging toilet brush with a drip area of 35 mm.
Removable plastic insert for optimal cleaning.

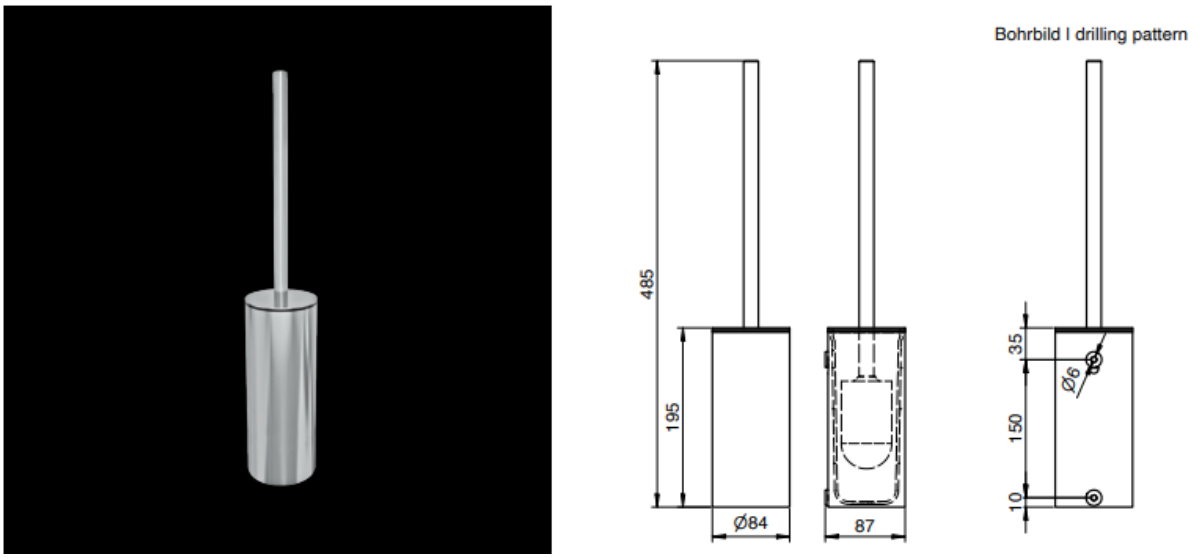

Figure8: Toilet brush set PU-505

2.3 Dimensions and data for stainless steel products

Table1: Dimensions and data for stainless steel products

Technical data	Unit	Product PU-100	Product PU-200
Total weight	kg	3.45	7.20
Weight stainless steel	kg	3.45	7.20
Packaging weight	kg	0.60	0.61
Stainless steel surface area	m	0.293	0.612
Sheet thickness	mm	1.5	1.5
Surface coating	m	0.103	0.520
Folds	Pcs	13	9
Welding length	m	0.54	0.00
Allocation	%	16.98	9.97

2.4 Masses and data mixed products

Table2: Masses and data for mixed products

Technical data	Unit	Product PU-140	Product PU-141	Product PU-400	Product PU-500	Product PU-505
Total weight	kg	2.0	1.50	4.51	1.15	1.12
Weight stainless steel	kg	1.81	1.39	4.00	0.94	0.93
Weight of plastic	kg	0.19	0.11	0.51	0.21	0.19
Weight of packaging	kg	0.15	0.10	0.50	0.20	0.13
Area Stainless steel	m	0.154	0.118	0.340	0.079	0.079
Sheet thickness	mm	1.5	1.5	1.5	1.5	2.0
Area Coating	m	0.130	0.100	0.170	0.032	0.040
Folds	Pcs	13	13	16	5	0
Weld length	m	0.33	0.33	0	0	0
Allocation	%	6.30	7.92	14.23	7.19	2.88

3 Objective and scope of the assessment

The assessment comprises a complete life cycle analysis (LCA) of the manufacturing process (from cradle to factory gate). It covers modules A1–A3 (raw material extraction, transport to the manufacturing plant, and manufacturing) of the products. The results serve as a basis for assessing the sustainability of the sanitary product in the tender phase and thus as a basis for decision-making for the most sustainable project possible.

4 Methodology

The life cycle assessment was created for the sanitary room equipment under consideration based on the
ecoinvent database (version 3.11). Energy and material flows are recorded in accordance with EN 15804.
For greater clarity, the products were divided into pure stainless steel products (entire product made of stainless steel) and mixed products (stainless steel housing and other components made of plastic). The products were then assessed separately. Several products from each product group were assessed individually and then compared with each other. This allowed an average value to be calculated within the product group. In addition, the maximum deviation from the average value was indicated in the results.
The results shown here represent all relevant environmental impacts according to EN 15804.
The assessment was carried out using SimaPro software (version 10.2).

4.1 Estimates

- Data from the manufacturer was generally used for the assessment. Where data was missing, generic data from the ecoinvent database was used. Since some manufacturing processes already took place in the supply chain and no direct insight into these processes is possible, assumptions or generic processes from the ecoinvent database also had to be used here.
- To calculate the PENRM of the plastic (non-renewable primary energy for material use), the calorific value from the ecoinvent database was used and calculated manually, as the SimaPro software provides incorrect results in this case.

4.2 Cut/off rules

All inputs and outputs for which data is available and which are expected to make a significant contribution are included in the life cycle assessment model. This means that no processes, materials, or emissions that are expected to make a significant contribution to the environmental impact of the products under consideration have been neglected.

5 Life cycle assessment results

5.1 Results for stainless steel products

The following tables show the life cycle environmental impacts for pure stainless steel products according to environmental indicators.
The results represent the average value of all products examined in the stainless steel product group. In addition, the tables also show the maximum deviations (in percent) from the average value. This allows the minimum values (negative deviation) and maximum values (positive deviation) to be calculated for each environmental indicator.

Declared unit: 1 kg finished product

Note:
To obtain the environmental impact for a specific product, the results must be multiplied by the respective weight of the finished product.

Table 3: Results of the LCA Environmental impacts for stainless steel products (A1-A3)

Parameter	Unit	Stainless steel products (average value)	PU-100	PU-200	Deviation from mean value [%]	
GWP total	kg CO_2 equiv	**8.70E+00**	8.82E+00	8.57E+00	-2.85	2.03
GWP fossil fuels	kg CO_2 equiv	**8.45E+00**	8.56E+00	8.33E+00	-2.79	1.96
GWP biogenic	kg CO_2 equiv	**2.33E-01**	2.42E-01	2.24E-01	-4.29	4.00
GWP luluc	kg CO_2 equiv	**1.83E-02**	2.01E-02	1.65E-02	-11.43	10.78
ODP	kg CFC-11 equiv	**1.01E-07**	1.05E-07	9.70E-08	-8.26	6.55
AP	mol H^+ equiv	**4.38E-02**	4.39E-02	4.38E-02	-2.74	3.18
EP freshwater	kg P equiv	**7.63E-03**	7.67E-03	7.60E-03	-1.10	0.65
EP marine	kg N equiv	**8.48E-03**	8.61E-03	8.35E-03	-2.58	1.81
EP terrestrial	mol N equiv	**8.30E-02**	8.39E-02	8.20E-02	-2.17	1.37
POCP	kg NMVOC equiv	**2.68E-02**	2.71E-02	2.66E-02	-2.51	1.45
ADPE	kg Sb equiv	**2.01E-04**	2.01E-04	2.01E-04	-0.82	0.91
ADPF	MJ H_u	**1.06E+02**	1.08E+02	1.05E+02	-3.62	2.38
WDP	m3 World equivalent	**2.92E+00**	2.94E+00	2.89E+00	-3.19	1.82
Key	GWP = Global warming potential; luluc = land use and land use change; ODP = Depletion potential of the stratospheric ozone layer; AP = Acidification potential. cumulative exceedance; EP = Eutrophication potential; POCP = Formation potential for tropospheric ozone; ADPE = potential for abiotic depletion of non-fossil resources; ADPF = potential for abiotic depletion of fossil fuels; WDP = water removal potential (user)					

Table4: Additional environmental indicators for stainless steel products (A1-A3)

Parameter	Unit	Stainless steel products (mean value)	PU-100	PU-200	Deviation from mean value [%]	
PM	Occurrence of diseases	**6.30E-07**	6.35E-07	6.25E-07	-1.45	1.06
IRP	kBq U235 equiv	**9.06E-01**	9.09E-01	9.03E-01	-3.26	2.00
ETP-fw	CTUe	**9.92E+01**	9.95E+01	9.88E+01	-1.03	0.61
HTP-c	CTUh	**1.03E-08**	1.03E-08	1.02E-08	-1.12	0.59
HTP-nc	CTUh	**1.58E-07**	1.58E-07	1.57E-07	-1.02	0.56
SQP	dimensionless	**5.16E+01**	5.33E+01	4.98E+01	-4.32	3.81
Key	PM = Potential occurrence of diseases due to particulate matter emissions; IRP = Potential effect of human exposure to U235; ETP-fw = Potential Toxicity Comparison Unit for ecosystems; HTP-c = Potential Toxicity Comparison Unit for humans - carcinogenic effect; HTP-nc = Potential toxicity comparison unit for humans - non-carcinogenic effect; SQP = Potential soil quality index					

Table5: Results of the LCA of resource use for stainless steel products (A1-A3)

Parameter	Unit	Stainless steel products (mean value)	PU-100	PU-200	Deviation from mean value [%]	
PERE	MJ H_u	**2.60E+01**	2.65E+01	2.56E+01	-2.93	2.25
PERM	MJ H_u	**0.00E+00**	0.00E+00	0.00E+00	-	-
PERT	MJ H_u	**2.60E+01**	2.65E+01	2.56E+01	-2.93	2.25
PENRE	MJ H_u	**1.07E+02**	1.08E+02	1.05E+02	-3.63	2.39
PENRM	MJ H_u	**0.00E+00**	0.00E+00	0.00E+00	-	-
PENRT	MJ H_u	**1.07E+02**	1.08E+02	1.05E+02	-3.63	2.39
SM	kg	**9.20E-01**	9.66E-01	8.74E-01	-5.03	4.99
RSF	MJ H_u	**1.49E-02**	1.90E-02	1.08E-02	-28.09	27.76
NRSF	MJ H_u	**0.00E+00**	0.00E+00	0.00E+00	-	-
FW	m^3	**8.53E-02**	8.59E-02	8.46E-02	-2.79	1.62
Key	PERE = Renewable primary energy as an energy source; PERM = Renewable primary energy for material use; PERT = Total renewable primary energy; PENRE = Non-renewable primary energy as energy source; PENRM = Non-renewable primary energy for material use; PENRT = Total non-renewable primary energy; SM = Use of secondary materials; RSF = Renewable secondary fuels; NRSF = Non-renewable secondary fuels; FW = Use of freshwater resources					

Table6: Results of the LCA output flows and waste categories – stainless steel products

Parameter	Unit	Stainless steel products (mean value)	PU-100	PU-200	Deviation from mean value [%]	
HWD	kg	**7.05E+00**	7.05E+00	7.05E+00	-0.27	0.20
NHWD	kg	**5.21E+01**	5.22E+01	5.21E+01	-1.18	0.95
RWD	kg	**2.32E-04**	2.33E-04	2.31E-04	-3.29	2.10
CRU	kg	**0.00E+00**	0.00E+00	0.00E+00	-	-
MFR	kg	**3.94E-01**	3.99E-01	3.88E-01	-1.45	1.43
MER	kg	**1.23E-04**	1.23E-04	1.23E-04	-0.64	1.15
EEE	MJ	**1.14E-01**	1.15E-01	1.13E-01	-4.89	2.06
EET	MJ	**1.73E-01**	1.73E-01	1.74E-01	-1.31	3.07
Key	HWD = Hazardous waste to landfill; NHWD = Non-hazardous waste disposed of; RWD = Radioactive waste disposed of; CRU = components for reuse; MFR = materials for recycling; MER = materials for energy recovery; EEE = Exported electrical energy; EET = Exported thermal energy					

5.2 Results for mixed products

The following tables show the life cycle environmental impacts for mixed products according to environmental indicators.
The results represent the average value of all products examined in the mixed products product group. In addition, the tables also show the maximum deviations (in percent) from the average value. This allows the minimum values (negative deviation) and maximum values (positive deviation) to be calculated for each environmental indicator.

Declared unit: 1 kg finished product

Note:
To obtain the environmental impact for a specific product, the results must be multiplied by the respective weight of the finished product.

Table 7: Results of the LCA Environmental impacts for mixed products (A1-A3)

Parameter	Unit	Mixed products (average value)	PU-140	PU-141	PU-400	PU-500	PU-505	Deviation from mean value [%]	
Total GWP	kg CO_2 equiv	**8.77E+00**	8.80E+00	9.21E+00	8.50E+00	8.58E+00	8.78E+00	-4.01	6.31
GWP fossil fuels	kg CO_2 equiv	**8.43E+00**	8.46E+00	8.81E+00	8.26E+00	8.24E+00	8.40E+00	-3.03	5.81
GWP biogenic	kg CO_2 equiv	**3.34E-01**	3.43E-01	3.94E-01	2.34E-01	3.26E-01	3.72E-01	-29.89	18.11
GWP luluc	kg CO_2 equiv	**1.64E-02**	1.53E-02	1.53E-02	1.63E-02	1.85E-02	1.63E-02	-8.27	14.20
ODP	kg CFC-11 equiv	**1.26E-07**	1.24E-07	1.34E-07	9.79E-08	1.36E-07	1.40E-07	-24.59	13.26
AP	mol H^+ equiv	**4.08E-02**	4.16E-02	4.26E-02	4.13E-02	3.91E-02	3.95E-02	-5.47	7.79
EP freshwater	kg P equiv	**6.87E-03**	7.06E-03	7.25E-03	6.87E-03	6.55E-03	6.64E-03	-5.05	5.99
EP marine	kg N equiv	**7.98E-03**	8.04E-03	8.25E-03	7.98E-03	7.83E-03	7.82E-03	-2.71	3.93
EP terrestrial	mol N equiv	**7.81E-02**	7.90E-02	8.11E-02	7.80E-02	7.60E-02	7.65E-02	-3.25	4.40
POCP	kg NMVOC equiv	**2.66E-02**	2.67E-02	2.74E-02	2.59E-02	2.64E-02	2.65E-02	-3.66	3.98
ADPE	kg Sb equiv	**1.79E-04**	1.85E-04	1.89E-04	1.79E-04	1.69E-04	1.72E-04	-5.90	6.95
ADPF	MJ H_u	**1.14E+02**	1.13E+02	1.17E+02	1.09E+02	1.15E+02	1.17E+02	-5.83	4.28
WDP	m3 World equivalent	**2.78E+00**	2.79E+00	2.85E+00	2.91E+00	2.67E+00	2.66E+00	-5.36	6.31
Key	GWP = Global warming potential; luluc = land use and land use change; ODP = Depletion potential of the stratospheric ozone layer; AP = Acidification potential. cumulative exceedance; EP = Eutrophication potential; POCP = Formation potential for tropospheric ozone; ADPE = potential for abiotic depletion of non-fossil resources; ADPF = potential for abiotic depletion of fossil fuels; WDP = water removal potential (user)								

Table8: Additional environmental indicators for mixed products

Parameter	Unit	Mixed products (mean value)	PU-140	PU-141	PU-400	PU-500	PU-505	Deviation from mean value [%]	
PM	Occurrence of diseases	**5.69E-07**	5.83E-07	5.98E-07	5.86E-07	5.37E-07	5.43E-07	-5.65	6.44
IRP	kBq U235 equiv	**8.38E-01**	8.52E-01	8.74E-01	8.12E-01	8.24E-01	8.27E-01	-3.10	9.65
ETP-fw	CTUe	**8.80E+01**	9.02E+01	9.24E+01	8.92E+01	8.35E+01	8.45E+01	-5.06	6.33
HTP-c	CTUh	**9.10E-09**	9.39E-09	9.66E-09	9.15E-09	8.58E-09	8.73E-09	-5.73	7.42
HTP-nc	CTUh	**1.42E-07**	1.46E-07	1.50E-07	1.41E-07	1.35E-07	1.38E-07	-4.53	6.64
SQP	dimensionless	**4.68E+01**	4.65E+01	4.71E+01	4.65E+01	4.80E+01	4.61E+01	-1.69	3.66
Key	PM = Potential occurrence of diseases due to particulate matter emissions; IRP = Potential effect of human exposure to U235; ETP-fw = Potential Toxicity Comparison Unit for ecosystems; HTP-c = Potential Toxicity Comparison Unit for humans - carcinogenic effect; HTP-nc = Potential toxicity comparison unit for humans - non-carcinogenic effect; SQP = Potential soil quality index								

Table9: Results of the LCA of resource use for mixed products

Parameter	Unit	Mixed products (mean value)	PU-140	PU-141	PU-400	PU-500	PU-505	Deviation from mean value [%]	
PERE	MJ H_u	**2.40E+01**	2.42E+01	2.51E+01	2.34E+01	2.36E+01	2.36E+01	-2.42	7.21
PERM	MJ H_u	**0.00E+00**	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	-	-
PERT	MJ H_u	**2.40E+01**	2.42E+01	2.51E+01	2.34E+01	2.36E+01	2.36E+01	-2.42	7.21
PENRE	MJ H_u	**1.13E+02**	1.11E+02	1.15E+02	1.08E+02	1.14E+02	1.16E+02	-4.49	5.75
PENRM	MJ H_u	**5.21E+00**	4.10E+00	3.17E+00	4.02E+00	7.73E+00	7.05E+00	-39.15	48.23
PENRT	MJ H_u	**1.13E+02**	1.11E+02	1.15E+02	1.08E+02	1.14E+02	1.16E+02	-4.49	5.75
SM	kg	**8.02E-01**	7.94E-01	8.04E-01	8.11E-01	8.23E-01	7.79E-01	-2.94	2.63
RSF	MJ H_u	**1.43E-02**	1.08E-02	9.84E-03	1.43E-02	2.09E-02	1.54E-02	-31.08	46.97
NRSF	MJ H_u	**0.00E+00**	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	-	-
FW	m^3	**7.95E-02**	7.97E-02	8.19E-02	8.25E-02	7.66E-02	7.68E-02	-3.61	7.07
Key	PERE = Renewable primary energy as an energy source; PERM = Renewable primary energy for material use; PERT = Total renewable primary energy; PENRE = Non-renewable primary energy as energy source; PENRM = Non-renewable primary energy for material use; PENRT = Total non-renewable primary energy; SM = Use of secondary materials; RSF = Renewable secondary fuels; NRSF = Non-renewable secondary fuels; FW = Use of freshwater resources								

Table10: LCA results for output flows and waste categories – mixed products

Parameter	Unit	Mixed products (mean value)	PU-140	PU-141	PU-400	PU-500	PU-505	Deviation from mean value [%]	
HWD	kg	**6.18E+00**	6.39E+00	6.54E+00	6.27E+00	5.80E+00	5.91E+00	-6.16	6.33
NHWD	kg	**4.82E+01**	4.94E+01	5.03E+01	4.63E+01	4.75E+01	4.76E+01	-3.92	6.49
RWD	kg	**2.14E-04**	2.18E-04	2.24E-04	2.08E-04	2.11E-04	2.11E-04	-3.05	9.80
CRU	kg	**0.00E+00**	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	-	-
MFR	kg	**4.21E-01**	3.51E-01	3.59E-01	3.49E-01	7.15E-01	3.30E-01	-21.47	69.91
MER	kg	**1.07E-04**	1.11E-04	1.13E-04	1.09E-04	1.01E-04	1.03E-04	-5.79	7.49
EEE	MJ	**1.11E-01**	1.11E-01	1.16E-01	1.03E-01	1.11E-01	1.12E-01	-6.78	11.17
EET	MJ	**1.53E-01**	1.57E-01	1.60E-01	1.54E-01	1.45E-01	1.47E-01	-4.92	9.68
Key	HWD = Hazardous waste to landfill; NHWD = Non-hazardous waste disposed of; RWD = Radioactive waste disposed of; CRU = components for reuse; MFR = materials for recycling; MER = materials for energy recovery; EEE = Exported electrical energy; EET = Exported thermal energy								

6 LCA interpretation

6.1 Interpretation Stainless steel products

6.1.1 Stainless steel products - CO_2emissions (GWP)

Explanation of global warming potential - GWP (Global Warming Potential):

Meaning: The GWP indicates how much a product or building contributes to global warming. In particular through CO_2, methane (CH_4) and nitrous oxide (N_2O). This value shows the CO_2 footprint of a product or building and is crucially relevant for climate protection strategies.

Unit: kg CO_2 equivalent (CO_2 eq)

Subdivided into:

- GWP fossil: Global warming potential from emissions released by the use of fossil fuels such as coal, oil, and gas.
- GWP biogenic: Global warming potential of greenhouse gas emissions that arise from biological processes, such as the use of biomass. This takes into account carbon uptake by plants and their decomposition.
- GWP luluc: Global warming potential of emissions and carbon storage resulting from land use, land use change, and forestry.
- GWP total: Sum of the above three parts

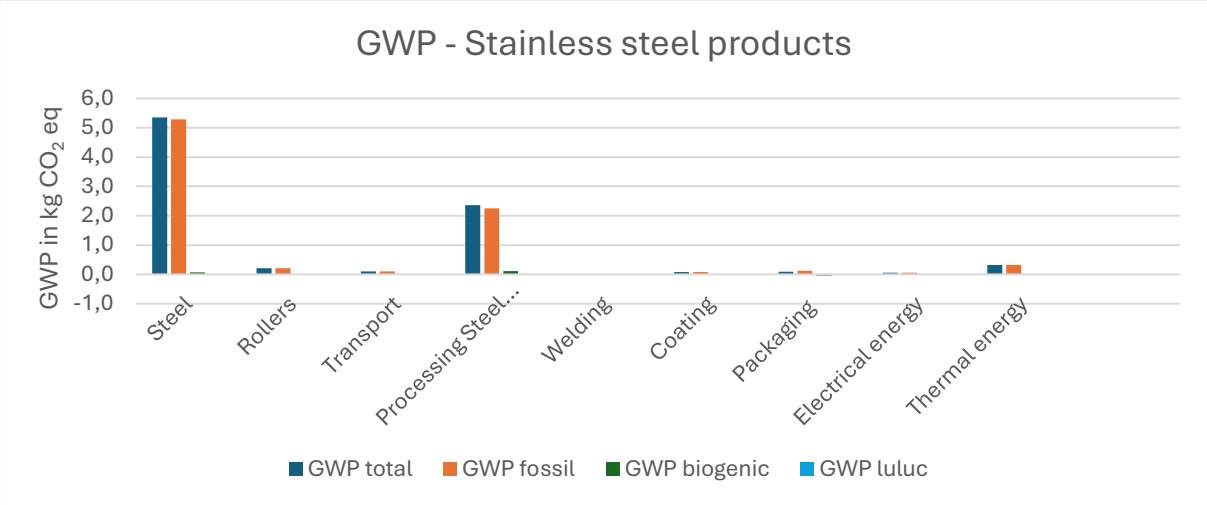

Figure9: CO_2 emissions (GWP) – stainless steel products

6.1.2 Stainless steel products - Primary energy

Explanation of primary energy consumption:

Meaning:	Records the total energy requirements of a product or building, broken down into renewable (e.g., solar, wind) and non-renewable energy (e.g., oil, gas). Primary energy consumption is one of the most important parameters for assessing the sustainability of products and buildings.
PERE	Renewable energy required for the manufacture of a product, including pre-processes.
PERM	Renewable energy that is permanently stored in the material and released during combustion.
PERT	Sum of PERE and PERM.
PENRE	Non-renewable energy required for the manufacture of a product, including pre-processes.
PENRM	Non-renewable energy that is permanently stored in the material and released during combustion.
PENRT	Sum of PENRE and PENRM.
Unit:	MJ (megajoule)

Primary energy renewable:

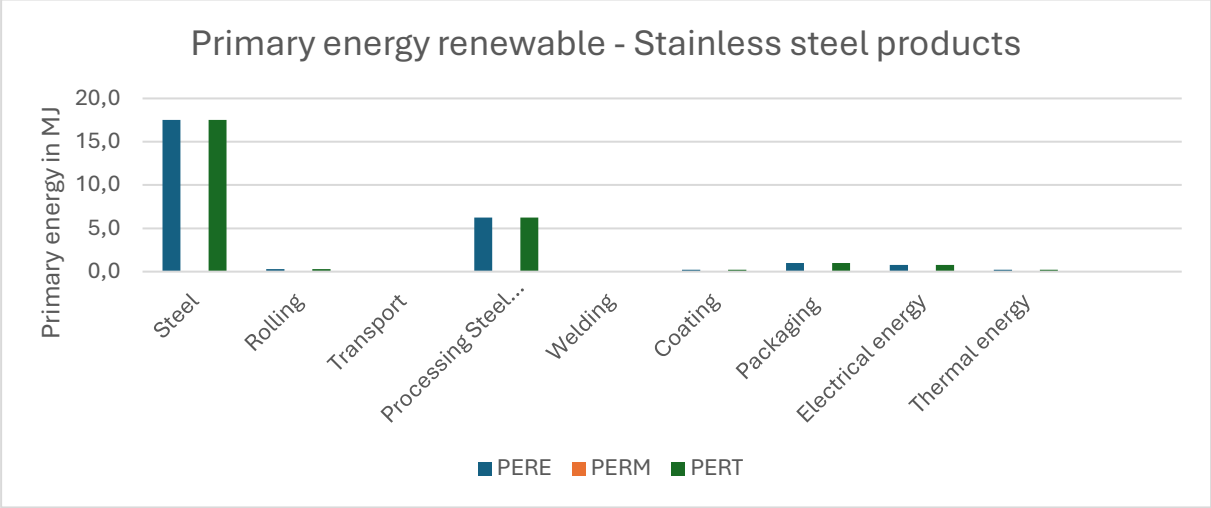

Figure10: Renewable primary energy – stainless steel products

Primary energy non-renewable:

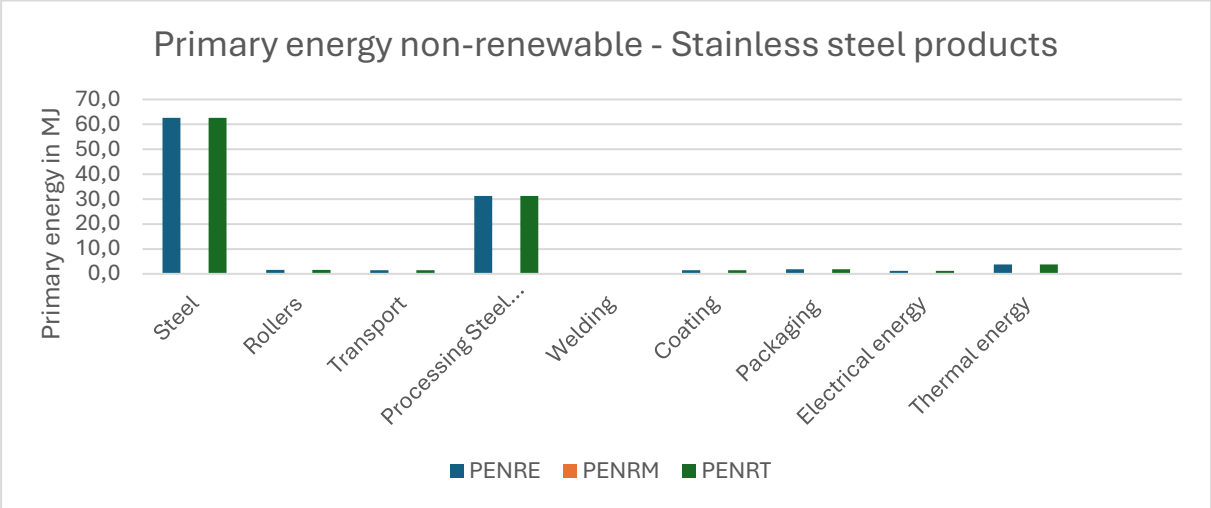

Figure11: Non-renewable primary energy – stainless steel products

6.1.3 Stainless steel products – Ozone depletion potential (ODP)

Explanation of ozone depletion potential – ODP:

Meaning: The ODP indicates how much a product or building contributes to the destruction of the ozone layer. Mainly through CFCs (chlorofluorocarbons). CFCs are very powerful greenhouse gases (100 to 10,000 times more powerful than CO_2)

Unit: kg CFC-11 equivalent

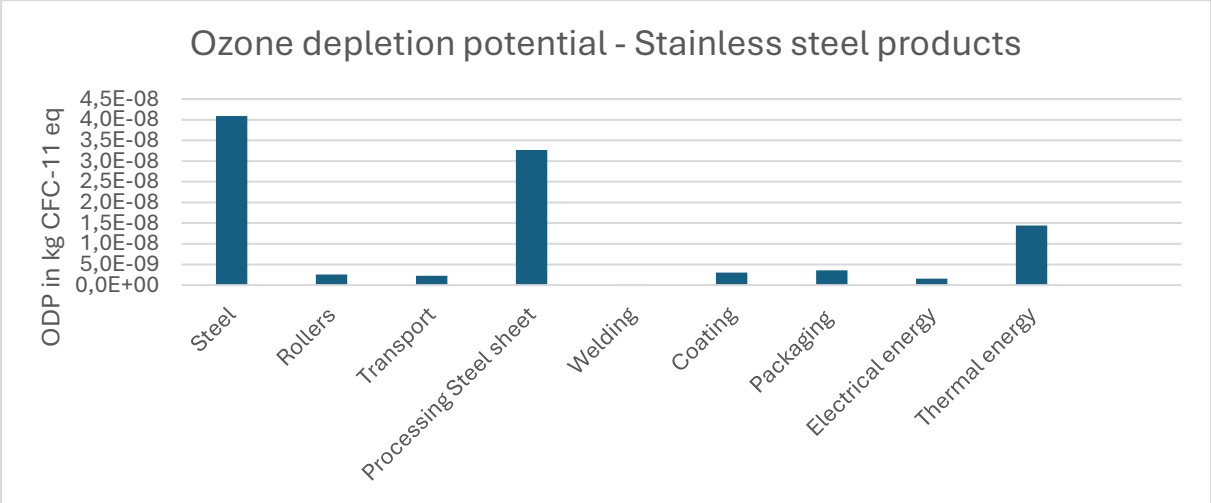

Figure12: Ozone depletion potential – stainless steel products

6.1.4 Stainless steel products Acidification potential (AP)

Explanation Acidification potential – AP:

Meaning: The AP indicates the release of pollutants such as sulphur dioxide (SO_2) or nitrogen oxides (NO_x), which cause acid rain and damage soil and water.

Unit: mol H+ equivalent

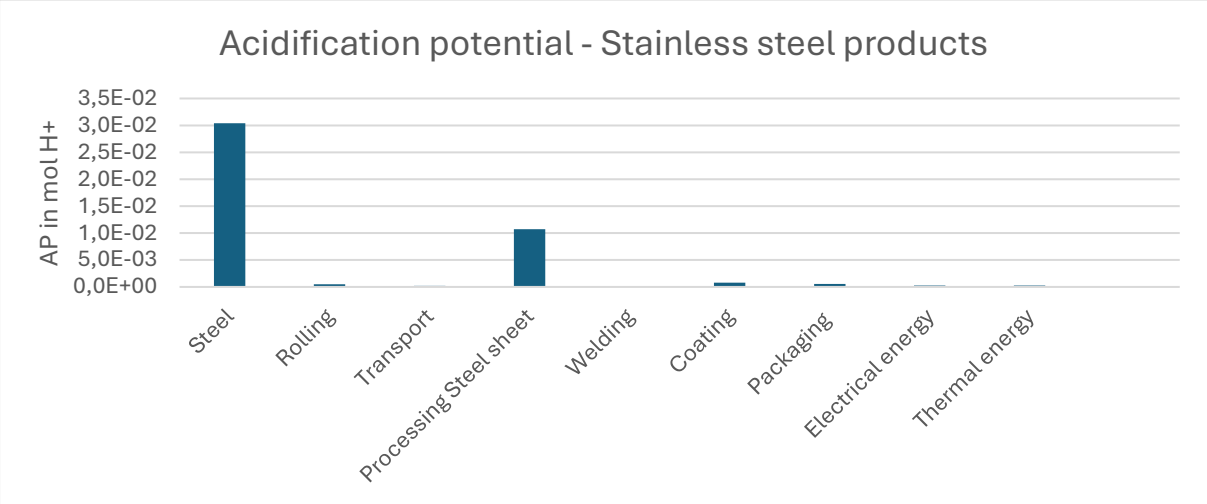

Figure13: Acidification potential – stainless steel products

6.1.5 Stainless steel products - Eutrophication potential (EP)

Explanation Eutrophication potential – EP:

Meaning:	The EP indicates the overfertilization of water bodies and soils with nitrogen and phosphorus compounds, which can cause algal blooms and oxygen depletion. A high EP leads to algae formation and oxygen depletion in water bodies, which causes fish to die. In the soil, it leads to the displacement of sensitive plants and contamination of groundwater (nitrate pollution).
Unit:	kg phosphate equivalent (kg P)

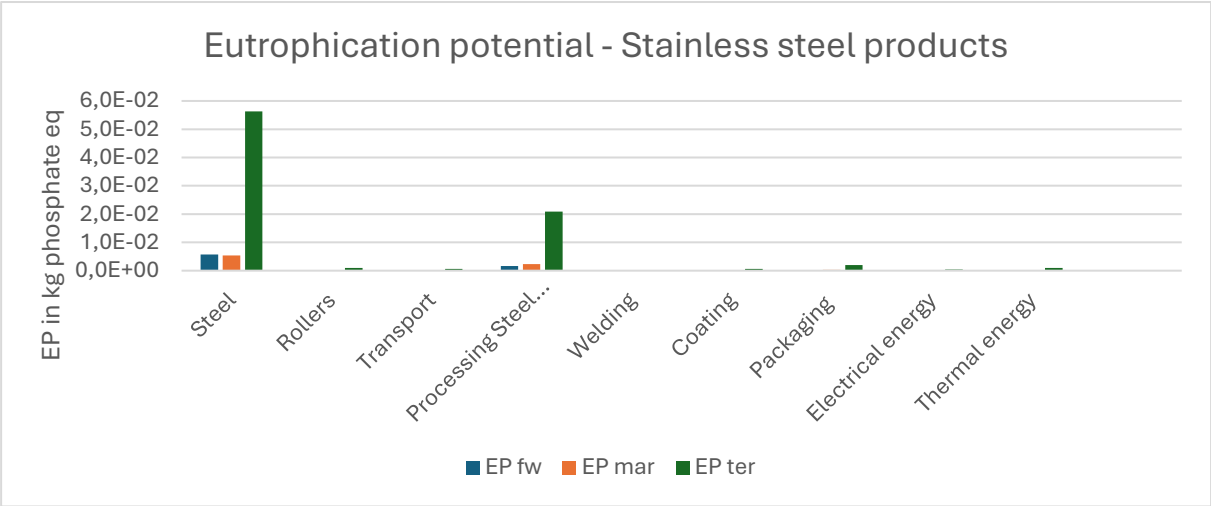

Figure14: Eutrophication potential – stainless steel products

6.1.6 Stainless steel products – dominance analysis

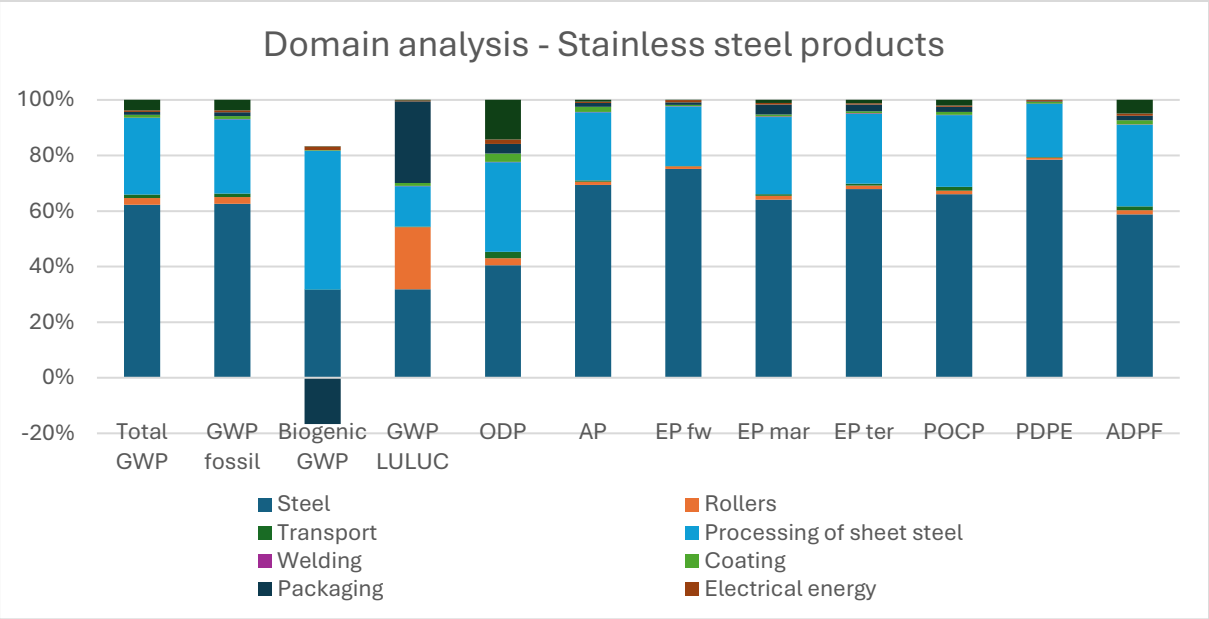

Figure15: Dominance analysis – stainless steel products

6.2 Interpretation of mixed products

6.2.1 Mixed products – CO_2emissions (GWP)

Explanation of greenhouse gas potential – GWP (global warming potential):

Meaning: The GWP indicates how much a product or building contributes to global warming. In particular through CO_2, methane (CH_4) and nitrous oxide (N_2O). This value shows the CO_2 footprint of a product or building and is crucially relevant for climate protection strategies.

Unit: kg CO_2equivalent (CO_2eq)

Subdivided into:

- GWP fossil: Global warming potential from emissions released by the use of fossil fuels such as coal, oil, and gas.
- GWP biogenic: Global warming potential of greenhouse gas emissions that arise from biological processes, such as the use of biomass. This takes into account carbon uptake by plants and their decomposition.
- GWP luluc: Global warming potential of emissions and carbon storage resulting from land use, land use change, and forestry.
- GWP total: Sum of the above three parts

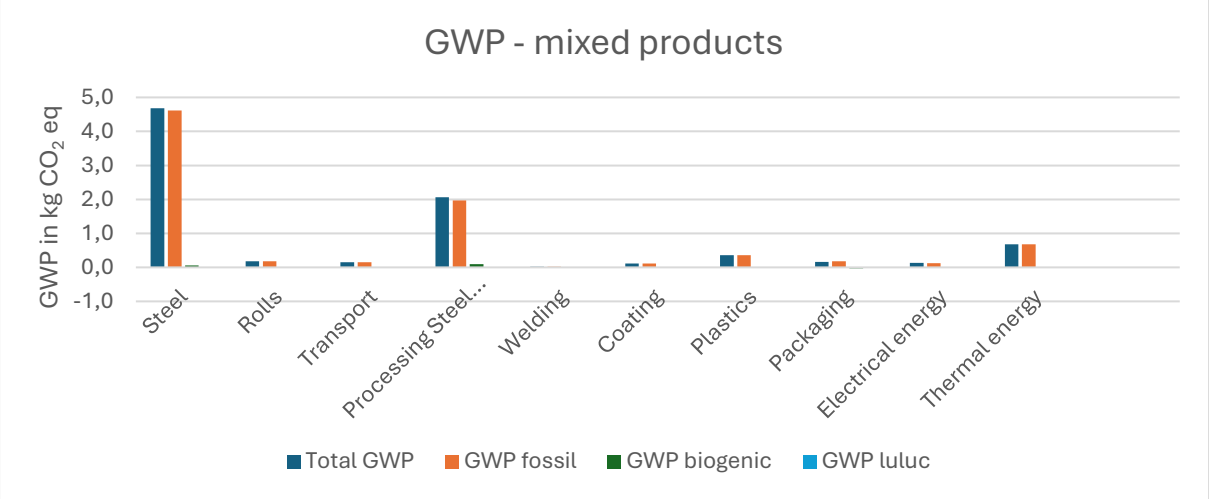

Figure16: CO_2 emissions (GWP) – mixed products

6.2.2 Mixed products – primary energy

Explanation of primary energy consumption:

Meaning:	Records the total energy requirements of a product or building, broken down into renewable (e.g., solar, wind) and non-renewable energy (e.g., oil, gas). Primary energy consumption is one of the most important parameters for assessing the sustainability of products and buildings.
PERE	Renewable energy required for the manufacture of a product, including pre-processes.
PERM	Renewable energy that is permanently stored in the material and released during combustion.
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PENRE	Non-renewable energy required for the manufacture of a product, including pre-processes.
PENRM	Non-renewable energy that is permanently stored in the material and released during combustion.
PENRT	Sum of PENRE and PENRM.
Unit:	MJ (megajoule)

Primary energy renewable:

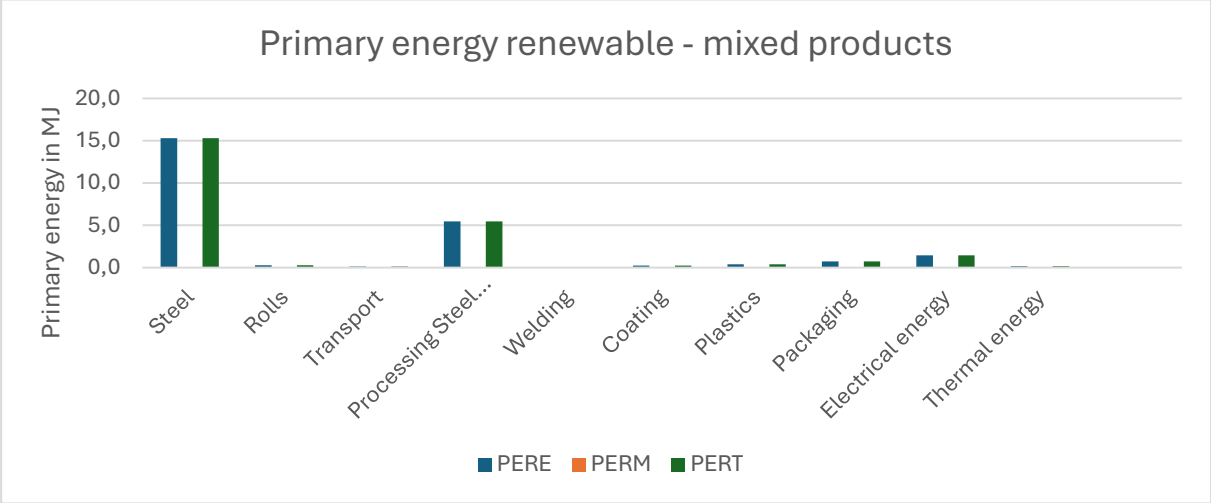

Figure17: Renewable primary energy – mixed products

Primary energy non-renewable:

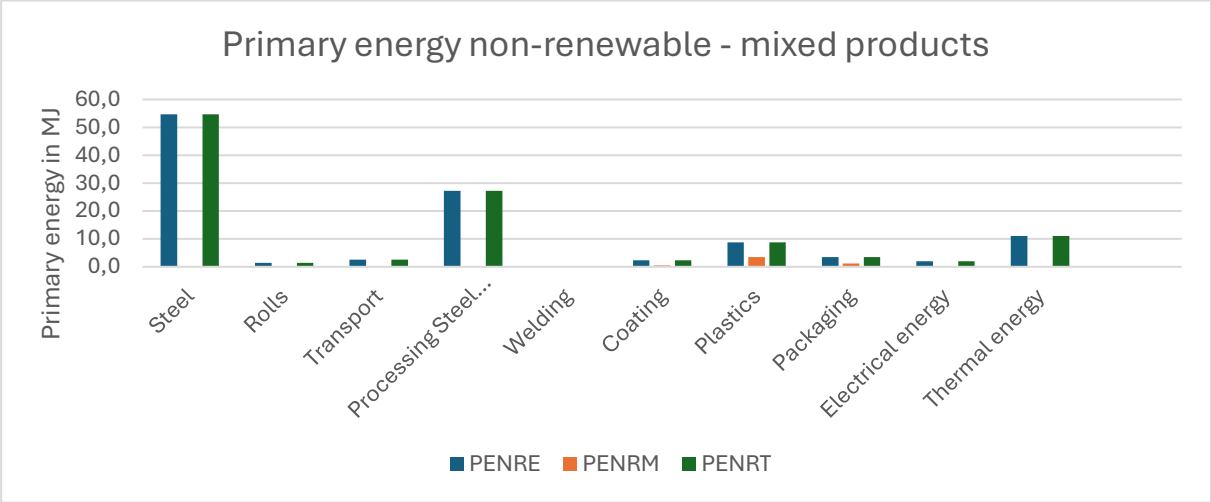

Figure18: Non-renewable primary energy – mixed products

6.2.3 Mixed products – ozone depletion potential (ODP)

Explanation Ozone depletion potential – ODP:

Meaning: The ODP indicates how much a product or building contributes to the destruction of the ozone layer. Mainly through CFCs (chlorofluorocarbons). CFCs are very powerful greenhouse gases (100 to 10,000 times more powerful than CO_2)

Unit: kg CFC-11 equivalent

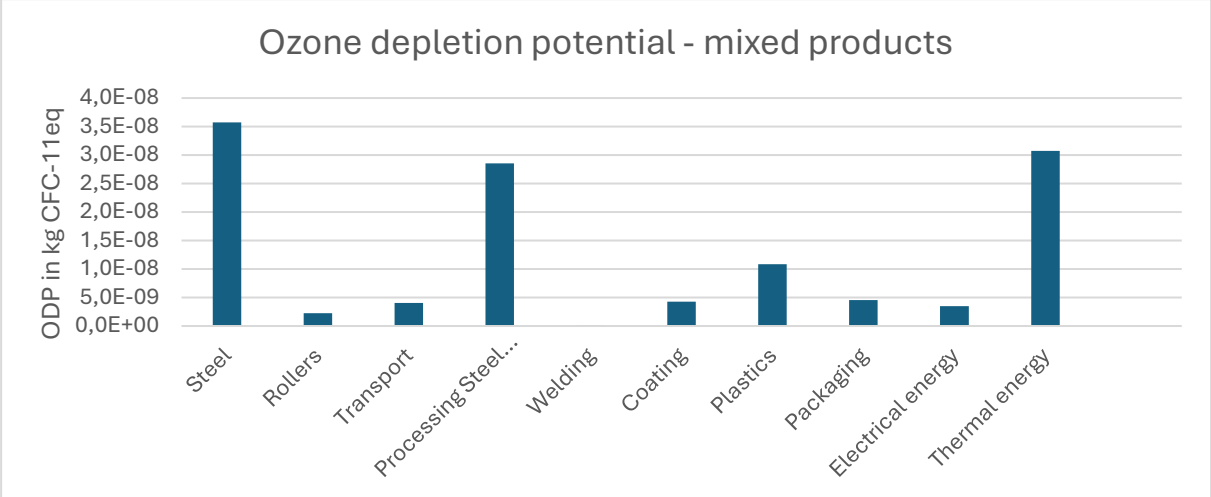

Figure19: Ozone depletion potential – mixed products

6.2.4 Mixed products Acidification potential (AP)

Explanation Acidification potential – AP:

Meaning: The AP indicates the release of pollutants such as sulfur dioxide (SO_2) or nitrogen oxides (NO_x), which cause acid rain and damage soil and water.

Unit: mol H+ equivalent

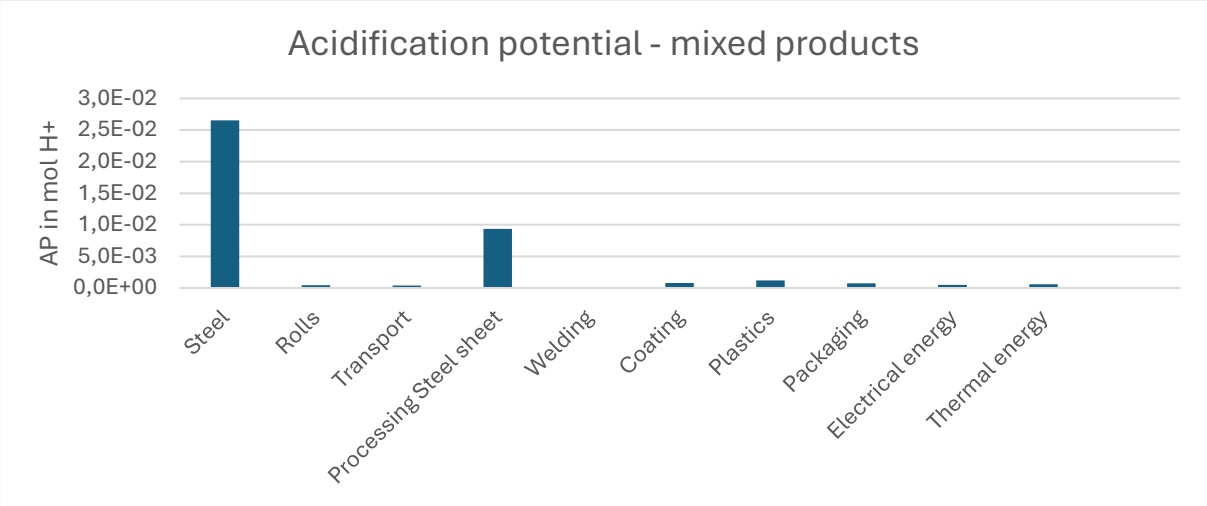

Figure20: Acidification potential – mixed products

6.2.5 Mixed products – eutrophication potential (EP)

Explanation Eutrophication potential – EP:

Meaning:	The EP indicates the overfertilization of water bodies and soils with nitrogen and phosphorus compounds, which can cause algal blooms and oxygen depletion. A high EP leads to algae formation and oxygen depletion in water bodies, which causes fish to die. In the soil, it leads to the displacement of sensitive plants and contamination of groundwater (nitrate pollution).
Unit:	kg phosphate equivalent (kg P)

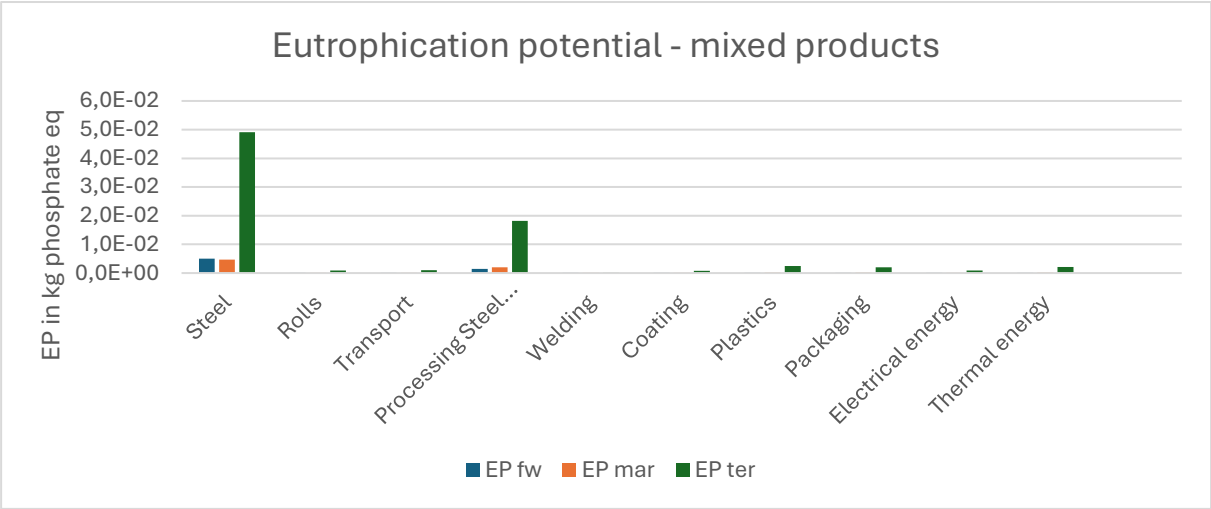

Figure21: Eutrophication potential – mixed products

6.2.6 Mixed products – dominance analysis

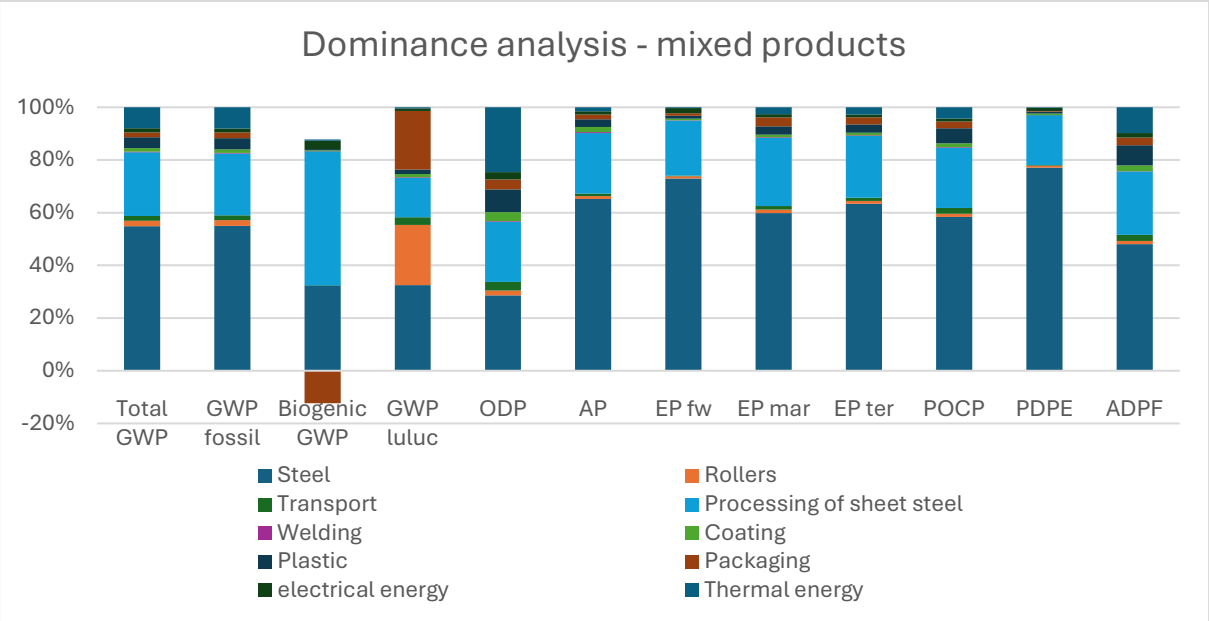

Figure22: Dominance analysis – mixed products

6.3 Interpretation of results

6.3.1 General

The results for pure stainless steel products differ only slightly from those for mixed products. In both product groups, steel and the further processing of steel sheet dominate almost all environmental impacts. Mixed products show slightly lower values for some indicators of environmental impact during the manufacturing phase. This can be explained by the use of plastic instead of steel. However, this difference would be offset or even reversed if the use phase were included in the assessment. Pure stainless steel products are very durable (the assessment assumes a service life of 80 years). In contrast, plastic components such as soap dispensers or toilet brushes need to be replaced earlier. The manufacturer specifies intervals of approximately 7 years for this. The replacement and subsequent disposal of these plastic parts increases the environmental impact of the mixed products in the use phase.
In general, the long service life and easy repairability of the products are very positive features. Even though the high proportion of stainless steel means that individual indicators show higher values, this is quickly offset by the long service life.

6.3.2 Interpretation of the results – stainless steel products

The global warming potential (GWP) is mainly determined by the steel and steel processing (laser cutting and bending). These processes account for approximately 94% of the total GWP.
In terms of ozone depletion potential (ODP), approximately 82% is attributable to steel and steel production, followed by electrical and thermal energy at 14%.
Primary energy is influenced by steel and steel processing by approximately 96% (renewable) and approximately 94% (non-renewable), respectively.
All other indicators (Table 3) are influenced by steel and steel production by 93 to 99%.

6.3.3 Interpretation of the results – mixed products

The global warming potential (GWP) is mainly determined by the steel and steel processing (laser cutting and bending). These processes account for approximately 83% of the total GWP. The remaining percentages are mainly distributed between plastic (4%) and thermal energy (8%).
In terms of ozone depletion potential (ODP), approximately 57% is attributable to steel and steel production, followed by electrical and thermal energy with approximately 27% and plastic with approximately 9%.
Primary energy is characterized by steel and steel processing at approximately 88% (renewable) and approximately 76% (non-renewable), respectively.
All other indicators (Table 3) are influenced by steel and steel production by 71 to 98%.

Inzing, January 16, 2026

Dipl.-Ing. Stefan Fritz

7 Appendix

7.1 List of figures

7.2 List of tables

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