LCA background report

reinforcing stabilized three and seven-wire strands with and without dents with a nominal tensile strength of 1670÷1860 N /mm2 with a diameter of 6.5÷15.7 mm (PC-strand)

PJSC "STALKANAT"

Program operator:	Kiwa-Ecobility Experts
Calculation number:	ReTHiNK-43821
Generation on:	08-12-2023
Issue date:	08-12-2023
Valid until:	08-12-2028
Status:	verified

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1 Verification of the life cycle assessment

The independent verification is in accordance with the ISO 14025:2011. The LCA is in compliance with ISO 14040:2006 and ISO 14044:2006. The EN 15804:2012+A2:2019 serves as the core PCR.

☐ Internal ☑ External

Third party verifier: Anne Kees Jeeninga, Advieslab

2 General

2.1 INTRODUCTION

This report for review is a result of a life cycle analysis (LCA) made by using the R<THiNK application. The report is based on the following chapters which correspond to the phases of a LCA.

- Goal and Scope Definition
- Life Cycle Inventory
- Impact assessment
- Interpretation of results

2.2 COMPANY INFORMATION / DECLARATION OWNER

Manufacturer: PJSC "STALKANAT"

Address: str. Vodoprovidna 16,, 65007 Odesa

E-mail:

Website: https://stalkanat.com.ua/

Production location: PJSC " Stalkanat"

Address production location: Vapnyana St, 52A, 65006 Odessa

2.3 INFORMATION LCA CALCULATION

LCA calculation for: reinforcing stabilized three and seven-wire strands with and without dents with a nominal tensile strength of 1670÷1860 N /mm2 with a diameter of 6.5÷15.7 mm (PC-strand)

Calculation number: ReTHiNK-43821

Generation on: 08-12-2023

Date of issue: 08-12-2023

End of validity: 08-12-2028

Version calculation core R<THiNK: v2.0

Version Environmental Profile database: v3.15 (2023-07-12)

PCR:

Kiwa-Ecobility Expert PCR B for construction steel products

2.4 COMPARABILITY

In principle, a comparison or assessment of the environmental impacts of different products is only possible if they have been prepared in accordance with EN 15804. For the evaluation of the comparability, the following aspects have to be considered in particular: PCR used, functional or declared unit, geographical reference, the definition of the system boundary, declared modules, data selection (primary or secondary data, background database, data quality), scenarios used for use and disposal phases, and the life cycle inventory (data collection, calculation methods, allocations, validity period). PCRs and general program instructions of different EPDs programs may differ. Comparability needs to be evaluated. For further guidance, see EN 15804+A2 (5.3 Comparability of EPD for construction products) and ISO 14025 (6.7.2 Requirements for comparability).

2.5 CALCULATION BASIS

LCA method R<THiNK: Ecobility Experts | EN15804+A2

LCA software*: Simapro 9.1

Characterization method: EN 15804 +A2 Method v1.0

LCA database profiles: EcoInvent version 3.6

Version database: v3.15 (2023-07-12)

* Used for calculating the characterized results of the Environmental profiles within R<THiNK.

2.6 COMPILER LCA

The project team for drafting this LCA consists the following persons

Anurag Bhakar

2.7 ABBREVIATIONS

EPD
Environmental Product Declaration

ECI
Environmental Cost Indicator

2 General

RSL
Reference service life

LCA
Life Cycle Assessment

PCR
Product Categorie Rules

3 Product

3.1 PRODUCT DESCRIPTION

This EPD applies to steel reinforcing stabilized three and seven-wire strands with or without dents with a nominal tensile strength of 1670÷1860 N/mm2 with the diameter of 6.5÷15.7 mm, produced by PJSC "STALKANAT".

The investigated product - PC-strand reinforcing strands is a twisted product of three or seven wires twisted together around a common axis. After laying on a cable machine, the strands are subjected to thermomechanical treatment (heating and stretching) to stabilize the mechanical properties.

Reinforcing strands are mainly used for the manufacture of precast concrete elements, hollow core slabs, beams, TT slabs or railway sleepers, as well as in post-tensioned structures such as bridges, viaducts or silos. For transportation and storage, the strands are wound into coils with in-line (precision) laying of the following sizes:

- outer diameter of the coil - no more than 1600 mm;

- inner diameter of the coil - 750 mm, 800 mm, 900 mm;

- bay width - 750 mm, 630 mm.

- weight (1 - 4) tons.

All reinforcing strands can be made from both smooth wire and dented wire. The standard tensile strength is 1860 MPa, but other strengths are available. Three-wire strands are twisted from wire of the same diameter. In seven-wire strands, the diameter of the center wire is at least 3% larger than that of the outer spiral wire. The standard geometric and mechanical properties of each bundle of strands are tested and verified in our own laboratory as well as in independent accredited laboratories in accordance with EN ISO 15630-3. They are also constantly monitored by the relevant certification bodies, ensuring full compliance with product standards.

The strands are wound into coils, which are tied with a metal tape 0.8x32 mm in 8 places evenly spaced around the skein.

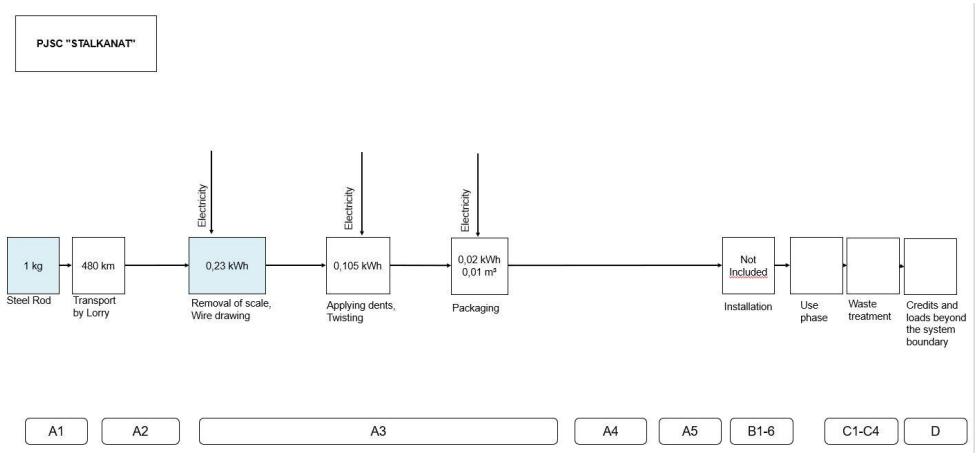
The strands are packed in polypropylene fabric. Packaging should protect the strand from mechanical damage and corrosion during transportation and storage.

After packing, the skein of strands is tied to wooden bars with a steel strap for easy transportation.

In standard environmental conditions, steel strands represent a stable product, devoid of any fire or explosion risks. However, it's crucial to note that polypropylene packaging fabric and wooden blocks, employed for stowage in vehicles during transportation to consumers, are susceptible to ignition in the presence of open flames. To mitigate this risk, it is imperative to exercise precautions. Specifically, during the storage and transportation phases, ensure a considerable distance from potential sources of ignition.

Product type according to REACH No. 1907/2006 – construction product. It is not classified as a hazardous substance. Conditions for safe storage, including any incompatibilities: Avoid moisture, acids and other factors that may corrode the metal. When warehousing and storing, keep the original packaging.

Information on toxicological effects: The product has no toxicological effects.



3.2 APPLICATION (INTENDED USE OF THE PRODUCT)

Reinforcing strands are mainly used for the manufacture of precast concrete elements, hollow core slabs, beams, TT slabs or railway sleepers, as well as in post-tensioned structures such as bridges, viaducts or silos. For transportation and storage, the strands are wound into coils with in-line (precision) laying of the following sizes:

- outer diameter of the coil - no more than 1600 mm;

- inner diameter of the coil - 750 mm, 800 mm, 900 mm;

- bay width - 750 mm, 630 mm.

- weight (1 ÷ 4) tons.

3.3 TECHNICAL DATA

In particular, the manufacturer declares the following information about the technical characteristics of the product:

3 Product

Tensile modulus

195 GPa ± 10% (strand)

Elongation ≥ 3.5% at L ≥ 500 mm

Low relaxation ≤ 2.5% after 1,000 hours of stress with a load of 70% of the breaking force.

A nominal tensile strength of 1670÷1860 N/mm2 with the diameter of D=4,85÷15,7 mm.

PJSC «Stalkanat» produces strands for the European Union according to the following standards: FprEN 10138-1,3:2009, prEN 10138 –1,3:2006, prEN 10138-1,3:2011, SFS 1265-1,3:2014, SS 212551:2013, SS 212553:2013, AT 001SC-01/314-2023, GOST 13840-68, BS 5896:2012, ÖNORM B 4758:2014, NMÉ: A-16/2018, NMÉ: A-27/2019, NEN 3868:2001, SI 1735, Part 4, ITB-KOT-2018/0637, NEN 3868:2001.

3.4 DESCRIPTION PRODUCTION PROCESS

The rebar plant receives the components necessary for the production of products: wire rod used as raw material and auxiliary products that are used at each stage of the process.

The production process consists of the following production steps:

- **Removal of scale mechanically.** Hot rolled products have a layer of iron oxides on their surface, which must be removed before drawing. This process is carried out on a surface preparation line installed in front of the drawing bench. The wire rod passes through the steel rollers, bends on them, the scale falls off the surface of the wire rod. After removing the scale in the rollers, the surface of the wire rod is treated with rotating steel brushes to remove any remaining scale. Then the wire rod is washed with water, coated with products (phosphate + borax) that promote lubrication at the next stage of wire drawing. Before drawing, the wire rod is dried with hot air.

- **Wire drawing.** In cold drawing, the wire rod is passed through several consecutive drawing dies installed on the drawing bench, which leads to a decrease in the cross section and a change in physical characteristics. To facilitate passage through the dies, powdered soaps are used to reduce the friction of the wire in the dies. When the wire rod passes through successive dies, the cross section is reduced to a given size, the material is also strengthened and the surface of the wire is smooth.

- **Applying dents.** To improve adhesion to concrete, the wire is passed through pinch rollers mounted on the drawing bench after the last die.

- **Twisting.** In this step, the wires are helically twisted into a strand in a rebar strand production line to form different types of strands.

- **Stabilization.** To eliminate the stresses in the wire that occur during the drawing process, the strands are thermomechanically treated under specified temperature conditions and tension, subsequently the strand is cooled with water at a controlled temperature, and finally air dried to prevent wetting and rusting of the strand.

- **Winding.** Reinforcing strands are wound into coils for shipment to the consumer.

- **Package.** Coils of strands are packed in polypropylene fabric.

3.5 REFERENCE SERVICE LIFE

RSL PRODUCT

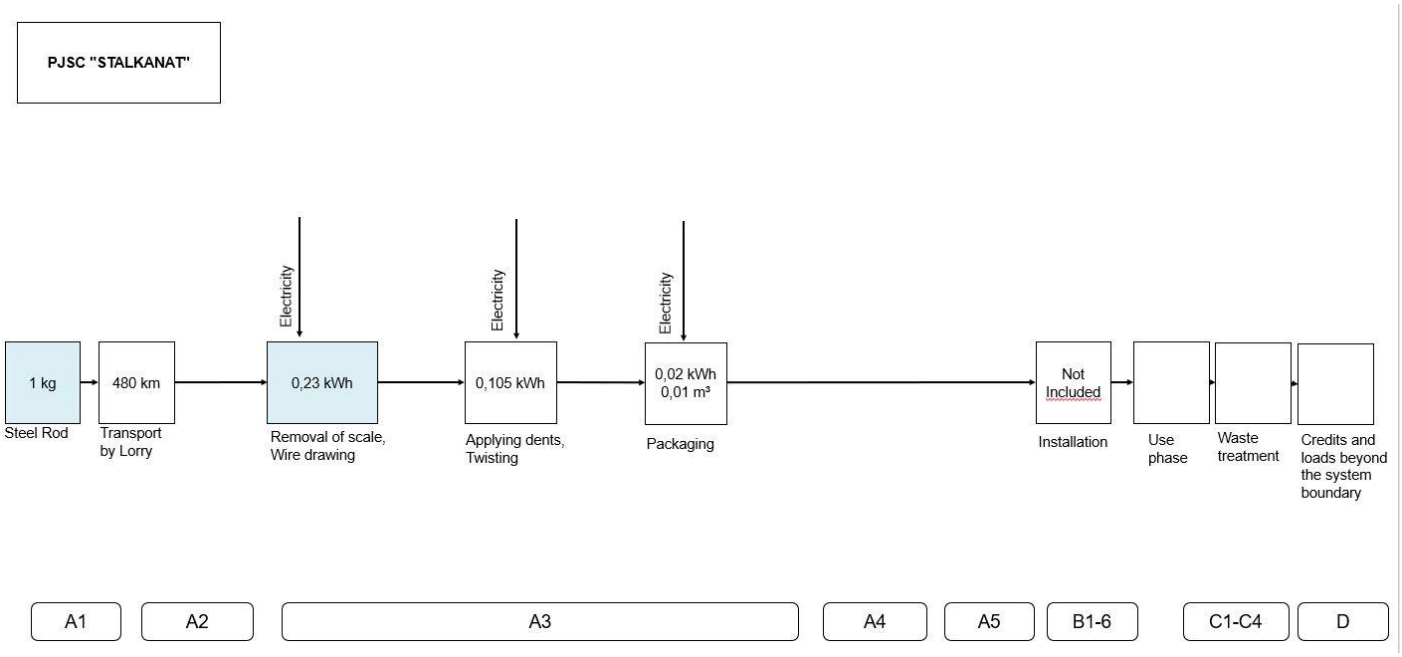
Since the service life of wire strands is not considered, there is no need to specify a reference service life. The generic life cycle of product can be considered as 100 years for any calculations basics.

USED RSL (YR) IN THIS LCA CALCULATION:

100

3 Product

3.6 PRODUCT FLOW DIAGRAM



4 Goal and Scope Definition

4.1 PURPOSE AND TARGET GROUPS

The purpose of this study is to define the environmental impact of the examined product by creating an Environmental Product Declaration (EPD) based on a Life Cycle Assessment (LCA). The potential environmental impacts are calculated in accordance with ISO 14040 and 14044, which define the LCA method. The EPD is created in accordance with ISO 14025, which defines principles and procedures of Type III environmental declarations, and EN 15084, which defines core rules for EPDs of construction products.

The EPD serves not only the determination of environmental impact of the product, but it also shows the material and energy flows of the production and therefore identifies potential for optimization. Due to the publication of the LCA results by an EPD it is possible to communicate the environmental impacts of the product towards relevant stakeholder groups. Furthermore, the EPD enables the calculation of the environmental impacts on a building level. Therefore, the results of this study can support a fact-oriented dialogue based on a transparent environmental information of the examined products and can be used for business-to-business (B2B) and/or business-to-customer (B2C) communication.

4.2 FUNCTIONAL UNIT

Kg

The declared functional unit is 1 kg. Other declared units are permissible if conversion to 1 kg is depicted in a transparent manner.

reference_unit: kilogram (kg)

4.3 CONVERSION FACTORS

Description	Value	Unit
reference_unit	1	kg
Conversion factor to 1 kg	1.000000	kg

4.4 REPRESENTATIVENESS

This EPD is representative for reinforcing stabilized three and seven-wire strands with and without dents with a nominal tensile strength of 1670÷1860 N /mm2 with a diameter of 6.5÷15.7 mm (PC-strand), a product of PJSC "STALKANAT". The results of this EPD are representative for European Union.

4 Goal and Scope Definition

4.5 SCOPE OF DECLARATION AND SYSTEM BOUNDARIES

This is a Cradle to gate with modules C1-C4 and module D LCA. The life cycle stages included are as shown below:

(X = module included, ND = module not declared)

A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
X	X	X	ND	ND	ND	ND	ND	ND	ND	ND	ND	X	X	X	X	X

The modules of the EN15804 contain the following:

Module A1 = Raw material supply	Module B5 = Refurbishment
Module A2 = Transport	Module B6 = Operational energy use
Module A3 = Manufacturing	Module B7 = Operational water use
Module A4 = Transport	Module C1 = De-construction / Demolition
Module A5 = Construction - Installation process	Module C2 = Transport
Module B1 = Use	Module C3 = Waste Processing
Module B2 = Maintenance	Module C4 = Disposal
Module B3 = Repair	Module D = Benefits and loads beyond the product system boundaries
Module B4 = Replacement	

4 Goal and Scope Definition

4.6 CUT-OFF CRITERIA

Product Stage (A1-A3)

The production stage consists of the extraction of raw materials, transportation of the raw materials, processing the raw materials into materials and the production of the product. The required energy for production, ancillary materials, packaging materials and production emissions are included. Processing of wire drawing and other emission are excluded as the impact is less than 1 % of the steel impact only the electricity and input materials are considered.

Construction process stage (A4-A5)

This stage consists the transport of the product from production plant to the construction site.

It also includes the loss of material during construction. The additional needed production, transport and end-of-life of the lost material during construction is included.

The end-of-life of packaging material up to the end-of-waste state or disposal of final residues is also included.

Use stage (B1-B3)

This stage consists of the impacts arising from components of the building and construction works during their use.

The stage also covers the combination of all planned technical and associated administrative maintenance actions during the service life to maintain the product installed in a building, in a construction works or its parts in a state in which it can perform its required functional and technical performance, as well as preserve the aesthetic qualities of the product. This will include preventative and regular maintenance activities.

Product replacement (B4) and renovation (B5) only apply when the product is considered in a lifespan (of a building, work , etc.).

Operational water and energy use are not considered.

End of life stage (C1-C4)

When the end of the life stage of the building is reached, the de-construction/demolition begins. This EPD includes de-construction/demolition (C1), the necessary transport (C2) from the demolition site to the sorting location and distance to final disposal. The end of life stage includes the final disposal to landfill (C4), incineration (C3) and needed recycling processes up to the end-of-waste point (C3). Loads and benefits of recycling, re-use and exported energy are part of module D.

The prescribed waste scenarios from the NMD Determination method v1.0 have been used for the various materials in the product.

Benefits and Loads beyond the system boundary (Module D)

This stage contains the potential loads and benefits of recycling and re-use of raw materials/products. The loads contain the needed recycling processes from end-of-waste-point up to the point-of-equivalence of the substituted primary raw material and a load for secondary material that will be lost at the end-of-life stage.

The loads and benefits of recycling and reuse are included in this module. The benefits are calculated based on the primary content and the primary equivalent.

In addition, the benefits of energy recovery are granted at this stage. The amount of avoid energy is based on the Lower Heating Values of the materials and the efficiencies of the incinerators as mentioned in the NMD Determination method v1.0 or EcoInvent 3.6 (2019)

In accordance with the criteria of the reference standard, the system has been extended as far as possible to avoid attributing environmental impacts to by-products of multi-unit processes within the manufacturing process.

If necessary, distribution was applied to the inputs and outputs of the system based on physical properties (mass or volume).

There was no need to apply economic criteria.

4.7 ALLOCATION

ALLOCATION USED ENVIRONMENTAL PROFILES / DATASETS

There is no allocation applied for the environmental profiles / datasets used in this LCA. For the sake of clarity, the generic processes which are not changed (e.g. EcoInvent waste treatment processes) are not shown in this overview.

4 Goal and Scope Definition

4.8 DATA COLLECTION & REFERENCE TIME PERIOD

2021-2022

4.9 ESTIMATES AND ASSUMPTIONS

The Purschase of Steel is generalized to 100% from Arcelor as mostly the steel is from Arcelor and sometimes(only in special cases of Non availability) it is purchased from other supplier and there is no fixed quantity for same hence, that can be neglected.

Electricity Mix is used according to the general low voltage electricty mix of Ukraine.

4.10 DATA QUALITY

Data quality is as per the data shared by the client with the measured values.

5 Life Cycle Inventory

5.1 RAW MATERIALS SUPPLY (A1)

To produce the product the following raw material inputs are needed per kilogram. The net amounts (leaving the factory gate as a product) are displayed. Excluding additional amounts related to production waste, construction waste, etc., these amounts are declared at the module they appear. The waste scenario is declared per raw material to show the connection between the amounts accounted for waste processing and the net raw material input. However, waste processing, final disposal and loads and benefit beyond the system boundaries are not declared in module A1 but in C3, C4 and D." The total amount of secondary content is displayed in kilograms.

Description	Environmental profile / dataset used*	Amount	Unit	Secondary content [%]	LHV [MJ/ kg]	Supplier	Waste Scenario used	Comments
Arcelor Mittal	Steel from Arcelor Mittal	1.000	kg	0.00		Arcelor Mittal	Steel, reinforcement (NMD ID 74)	
Total [kg]		**1.000**		**0.000**				

* A shortened name for the used process/data set is presented in the report. The full name of the used data set is shown at Annex 10.3

5.2 TRANSPORT TO MANUFACTURER (A2)

The raw materials are transported from the production location and/or mining location of the supplier to the production location of the manufacturer. The following transport conveyances and distances are applicable for suppliers of the raw materials.

Supplier	Transport conveyance 1	Distance 1 [km]
Arcelor Mittal	Rail (train)	480

5.3 PRODUCTION PROCESS (A3)

ENERGY CONSUMPTION

To produce the product the following energy inputs are needed per kilogram.

Description	Environmental profile / dataset used*	Amount	Unit	Supplier	Comments
Energy	Ukraine Low Voltage electricity Mix	0.335	kWh	n.a.	

5 Life Cycle Inventory

* A shortened name for the used process/data set is presented in the report. The full name of the used data set is shown at Annex 10.3

EMISSIONS

During production the following emissions to soil, water and/or air take place, per kilogram of the product;

Description	Environmental profile / dataset used*	Amount	Unit	Comments
Wire Drawing Emmission	Wire processing	1.000	kg	

* A shortened name for the used process/data set is presented in the report. The full name of the used data set is shown at Annex 10.3

EXTERNAL TREATMENTS

No treatments are performed by an external party during the production of the product.

PRODUCTION WASTE

The following amount of waste is generated during production per kilogram of the product. The additional needed raw materials, transport to the production plant and end-of-life scenario of the production waste are all included in module A3. Detailed information of the used waste scenario(s) can be found at chapter 6 Waste scenarios.

Description	Environmental profile / dataset used*	Amount	Secondary content [%]	LHV [MJ/kg]	Supplier	Waste Scenario used
Arcelor Mittal	Steel from Arcelor Mittal	0.027	0.00		Arcelor Mittal	Steel, reinforcement (NMD ID 74)
Total [kg]		**0.027**	**0.000**			

* A shortened name for the used process/data set is presented in the report. The full name of the used data set is shown at Annex 10.3

PACKAGING MATERIALS

The following amount of packaging materials is used for the product per kilogram. The production of the packaging materials and transport to the production plant are included in module A3. Waste processing, final disposal of the packaging material is included in module A5, loads and benefits beyond the system boundary in module D.

Description	Environmental profile / dataset used*	Amount	Unit	Secondary content [%]	LHV [MJ/kg]	Supplier	Comments
Polypropylene	Polypropylene (PP), woven | production (EU)	0.000	kg	0.00	32.78	ODETEX	
Metal Tape	Steel, low-alloyed, converter | production (EU)	0.006	kg	10.57		BEKAP METAL İNŞAAT SAN. VE TİC. A.Ş	

5 Life Cycle Inventory

Description	Environmental profile / dataset used*	Amount	Unit	Secondary content [%]	LHV [MJ/kg]	Supplier	Comments
Total [kg]		**0.007**		**0.001**			

* A shortened name for the used process/data set is presented in the report. The full name of the used data set is shown at Annex 10.3

ANCILLARY MATERIALS

The following amount of ancillary materials is used for the product kilogram. The production of the used ancillary materials, transport to the production plant and end-of-life scenario of the ancillary materials are all included in module A3. Detailed information of the used waste scenario(s) can be found at chapter 6 Waste scenarios.

Description	Environmental profile / dataset used*	Amount	Unit	Secondary content [%]	LHV [MJ/kg]	Supplier	Waste Scenario used	Comments
Water	Tap water - part of the product	0.000	kg	0.00		ODETEX	waste not applicable or evaporated (empty scenario) (NMD ID 26)	
Drawing Lubricant	Lubricating oil | production (EU)	0.001	kg	0.00	34.7	Pan Chemicals S.p.A.	Waste mineral oil (100% Incineration)	
Phosphate Concentrate	Concentrated Phosphate	0.001	kg	0.00		Nanjing Leading Chemical Co., Ltd.	waste not applicable or evaporated (empty scenario) (NMD ID 26)	
Borax	Borax, anhydrous, powder | production (EU)	0.000	kg	0.00		Nanjing Leading Chemical Co., Ltd.	finishes (adhered to wood, plastic, metal) (NMD ID 2)	
Total [kg]		**0.002**		**0.000**				

* A shortened name for the used process/data set is presented in the report. The full name of the used data set is shown at Annex 10.3

TRANSPORT TO MANUFACTURER

The following transport conveyances and distances to the production location are assumed. The supplier is stated per input flow at this module. The suppliers taken into account for production waste related to the net inputs at module A1 are declared at chapter 5.2.

Supplier	Transport conveyance 1	Distance 1 [km]	Transport conveyance 2	Distance 2 [km]

5 Life Cycle Inventory

Supplier	Transport conveyance 1	Distance 1 [km]	Transport conveyance 2	Distance 2 [km]
ODETEX	Lorry (Truck), unspecified (default) | market group for (GLO)	1		
Pan Chemicals S.p.A.	Lorry (Truck), unspecified (default) | market group for (GLO)	2250		
Nanjing Leading Chemical Co., Ltd.	Transoceanic freight ship, dry bulk goods	7854	Lorry (Truck), unspecified (default) | market group for (GLO)	595
BEKAP METAL İNŞAAT SAN. VE TİC. A.Ş	Lorry (Truck), unspecified (default) | market group for (GLO)	1200		

OUTPUT FLOWS AT MODULE A3

The waste scenario(s) applicable for the production waste and/or ancillary materials are resulting in the following output flows at module A3:

Waste Scenario	Not removed (stays in work) [kg]	Landfill [kg]	Incineration [kg]	Recycling [kg]	Re-use [kg]
Production waste					
Steel, reinforcement (NMD ID 74)	0	0.00134	0	0.02546	0
Total	**0.000**	**0.001**	**0.000**	**0.025**	**0.000**

In the EN15804 is stated that, as a general rule, potential loads and/or benefits from modules A1-A3 do not appear in module D. Therefore the potential loads and/or benefits from A1-A3 as a result of the output flows in from the production stage are declared in module A3. The following table shows the amount of potential loads and/or benefits beyond the system boundaries that are taken into account.

The primary equivalent that has been accounted as benefit when recycling and/or reusing primary material (net output) are stated in chapter 6 Waste scenarios. This chapter also contains the process taken into account as a benefit for energy recovery for the energy amount as stated in the following table.

The avoided primary material [kg] is determined by multiplying the primary content in kg with the percentage going to recycling or re-use. Secondary material lost [kg] is determined by multiplying the secondary content in kg with the percentage NOT going to recycling and/or re-use. The net output flow [kg] is determined by avoided primary material [kg] minus secondary material lost [kg] resulting in the net output flow.

5 Life Cycle Inventory

Waste Scenario	Avoided primary material, recycling [kg]	Avoided primary material, reuse [kg]	Secondary material lost [kg]	Net output flow [kg]	Energy recovery [MJ]
Production waste					
Steel, reinforcement (NMD ID 74)	0.02546	0	0	0.02546	0
Total	**0.025**	**0.000**	**0.000**	**0.025**	**0.000**

The amount of secondary material lost during the production stage is based on the following raw materials which consist (partly) of secondary content:

Environmental profile / dataset	Secondary material lost [kg]	Primary equivalent accounted as load
Total	**0.000**	

5.4 DE-CONSTRUCTION, DEMOLITION (C1)

It was determined that Stage C1, which represents the demolition or end-of-life stage, is zero as it is allocated to the demolition of reinforced concrete.

No inputs are needed for the product at the de-construction / demolition phase

5.5 TRANSPORT END-OF-LIFE (C2)

The applicable end-of-life transport scenarios are in detail described in chapter 6 Waste scenarios.

5.6 WASTE PROCESSING (C3)

After demolition and transport of the waste streams to the applicable waste processing routes, the waste is processed for final disposal or recycling and/or reuse. The calculated quantities and the applicable end-of-life scenario are shown below. The processes taken into account for waste processing are shown in chapter 6.3.

Waste Scenario	Incineration [kg]	Recycling [kg]	Re-use [kg]
Steel, reinforcement (NMD ID 74)	0.000	0.950	0.000
Total	**0.000**	**0.950**	**0.000**

5 Life Cycle Inventory

5.7 FINAL DISPOSAL (C4)

Some waste streams are not used for reprocessing or energy recovery but are final disposed. This is the case when the material is land-filled and/or when the product is not removed and stays in the work. The following amounts per final disposal stream are applicable for the product. The processes taken into account for the type of final disposal can be found at the applicable waste scenario in chapter 6.4.

Waste Scenario	Not removed (stays in work) [kg]	Landfill [kg]
Steel, reinforcement (NMD ID 74)	0.000	0.050
Total	**0.000**	**0.050**

5.8 BENEFITS AND LOADS BEYOND THE SYSTEM BOUNDARY

In R<THiNK the net output flow is determined by the amount of avoided primary material minus the amount of secondary material lost. Although the presentation of the figures (by presenting and calculating them separately) is slightly different from the formulas in annex D of the EN15804+A2. The actual calculated net output flow is equal. An example for 1kg that consists of 25% secondary content and will be recycled for 95%, the other 5% will be land filled.

Formula EN15804+A2:

net output flow = 95% recycling output - 25% secondary input (recycled content) = 0.95kg - 0.25kg = **0.70kg**

Formulas RETHiNK:

Benefits recycling = kg to recycling * %primary = 0.95kg*75% = 0.7125 kg
Secondary material lost = kg secondary * % not recycled or reused = 0,25kg * 5% = 0.0125 kg
net output flow = benefits recycling - secondary material lost = 0.7125-0.0125 = **0.70 kg**

LOADS AND BENEFITS BEYOND THE SYSTEM BOUNDARY

When materials are recycled or reused a benefit may be taken into account in module D. According to the EN15804 the benefit may only be calculated for the net primary input that comes available for the next life cycle stage by recycling or re-use (net output flow of secondary material). The amount assumed for recycling and re-use are listed per input in the table below. The amount of avoided production of primary material is also shown.

In chapter 6.6 the avoided primary equivalent for recycling and re-use and the assumed Q factor (Qr out / Qsub) are listed per waste scenario. In chapter 6.5 the additional needed

5 Life Cycle Inventory

loads to equal the avoided primary equivalent after reaching the end-of-waste state are declared.

The amount of energy content (LHV in MJ) taken into account for energy recovery by incineration of the materials is also listed. The avoided energy mix and thermal and electric efficiency for the incinerators taken into account are shown at chapter 6.7.

Waste Scenario	Avoided primary material, recycling [kg]	Avoided primary material, reuse [kg]	Secondary material lost [kg]	Net output flow [kg]	Energy recovery [MJ]
Steel, reinforcement (NMD ID 74)	0.950	0.000	0.000	0.950	0.000
Total	**0.950**	**0.000**	**0.000**	**0.950**	**0.000**

When a secondary material is lost at the end-of-life stage, by leaving the product in the construction work/ground, incinerating or land filling a load for the lost secondary material must be taken into account in module D. In the EN15804+A2 this is arranged by the calculation of the net output flow. As described before in R<THiNK this net amount is determined by the amount of avoided primary material minus the amount of secondary material lost.

The following table shows the amount of secondary material lost and when applicable which primary equivalent is taken into account for calculating the load to address to module D.

Environmental profile / dataset	Secondary material lost [kg]	Primary equivalent accounted as load
Steel, low-alloyed, converter | production (EU)	6.867e-6	Benefits module D | World Steel method (Steel production, electric, low-alloyed - Steel production, converter, unalloyed)
Total	**0.000**	

6 Waste Scenarios

In this chapter the used waste scenarios for waste generated during production, construction, use and end-of-life are shown. Per needed input at every stage of the life cycle assessment the used waste scenario is declared. The used scenario design, used processes for impacts and other assumptions are listed per paragraph in this chapter.

6.1 SCENARIO DESIGN

The following scenario design is used per type of waste scenario.

Waste Scenario	Region	Not removed (stays in work) [%]	Landfill [%]	Incineration [%]	Recycling [%]	Re-use [%]
Steel, reinforcement (NMD ID 74)	NL	0	5	0	95	0
waste not applicable or evaporated (empty scenario) (NMD ID 26)	NL	0	0	0	0	0
Waste mineral oil (100% Incineration)	NL	0	0	100	0	0
finishes (adhered to wood, plastic, metal) (NMD ID 2)	NL	0	0	100	0	0
polyolefines (i.a. pe,pp) (i.a. pipes, foils) (NMD ID 57)	NL	0	10	85	5	0
Steel, light (NMD ID 73)	NL	0	1	0	87	12

The following considered transport conveyance(s) and distances per waste flow are used for the (different) waste scenario(s).

Waste Scenario	Transport conveyance*	Not removed (stays in work) [km]	Landfill [km]	Incineration [km]	Recycling [km]	Re-use [km]
Steel, reinforcement (NMD ID 74)	Lorry (Truck), unspecified (default) | market group for (GLO)	0	100	150	50	0
waste not applicable or evaporated (empty scenario) (NMD ID 26)	Lorry (Truck), unspecified (default) | market group for (GLO)	0	0	0	0	0
Waste mineral oil (100% Incineration)	Lorry (Truck), unspecified (default) | market group for (GLO)	0	100	150	50	0
finishes (adhered to wood, plastic, metal) (NMD ID 2)	Lorry (Truck), unspecified (default) | market group for (GLO)	0	100	150	50	0
polyolefines (i.a. pe,pp) (i.a. pipes, foils) (NMD ID 57)	Lorry (Truck), unspecified (default) | market group for (GLO)	0	100	150	50	0
Steel, light (NMD ID 73)	Lorry (Truck), unspecified (default) | market group for (GLO)	0	100	150	50	0

6 Waste Scenarios

* A shortened name for the used process/data set is presented in the report. The full name of the used data set is shown at Annex 10.3

6.2 END OF WASTE POINT

In accordance with the EN15804 all process needed up until the end-of-waste point must be taken into account in module C. In the following table the used end-of-waste point for recycling for each used waste scenario is listed. When not applicable, when for example the scenario consists only of 100% incineration, it is declared at the waste scenario.

Waste Scenario	Substantiation End-of-Waste point
Steel, reinforcement (NMD ID 74)	The iron or steel scrap shall have been segregated at source or while collecting and been kept separate; or the input wastes shall have been treated to separate the iron and steel scrap from the non-metal and nonferrous components. All mechanical treatment (like cutting, shearing, shredding or granulating; sorting, separation, cleaning, de-polluting, emptying) needed to prepare the material for direct input into final use shall have been completed. [End-of-waste Criteria for Iron and Steel Scrap: Technical Proposals, Publications Office of the European Union, 2010]. In accordance with the world steel method the impact of recycling is included in module D.
waste not applicable or evaporated (empty scenario) (NMD ID 26)	Not applicable
Waste mineral oil (100% Incineration)	Not applicable the end-of-waste status is not reached.
finishes (adhered to wood, plastic, metal) (NMD ID 2)	Not applicable, when incinerating (efficiency <60%) the end-of-waste status is not reached.
polyolefines (i.a. pe,pp) (i.a. pipes, foils) (NMD ID 57)	Waste plastic streams used as input shall, once received by the producer or importer, be kept permanently separate from the contact with any other waste, including other waste plastic grades. All treatments needed to prepare the waste plastic for direct input in a free flowing form to manufacturing of plastic products, such as de-baling, sorting, separating, size-reducing, cleaning, melting, filtering, regranulating, or grading, shall have been completed. [End-of-waste criteria for waste plastic for conversion. Technical proposals, Publications Office of the European Union, 2014]
Steel, light (NMD ID 73)	The iron or steel scrap shall have been segregated at source or while collecting and been kept separate; or the input wastes shall have been treated to separate the iron and steel scrap from the non-metal and nonferrous components. All mechanical treatment (like cutting, shearing, shredding or granulating; sorting, separation, cleaning, de-polluting, emptying) needed to prepare the material for direct input into final use shall have been completed. [End-of-waste Criteria for

6 Waste Scenarios

Waste Scenario	Substantiation End-of-Waste point
	Iron and Steel Scrap: Technical Proposals, Publications Office of the European Union, 2010]. In accordance with the world steel method the impact of recycling is included in module D.

6 Waste Scenarios

6.3 WASTE PROCESSING

The following processes are taken into account for each waste processing type. The applicable amount(s) can be found at chapter 5, where all inventory data is declared.

Waste Scenario	Waste processing type	Used environmental profile / dataset*
Steel, reinforcement (NMD ID 74)	Recycling	Materials for recycling, no waste processing taken into account
Waste mineral oil (100% Incineration)	Incineration	Waste mineral oil {Europe without Switzerland}| treatment of waste mineral oil, hazardous waste incineration | Cut-off, U
finishes (adhered to wood, plastic, metal) (NMD ID 2)	Incineration	Waste paint {Europe without Switzerland}| treatment of waste paint, municipal incineration
polyolefines (i.a. pe,pp) (i.a. pipes, foils) (NMD ID 57)	Incineration	Waste treatment of 21% PE, 21% PP, 20% PVC, 17% PS en 21% mixture {CH], municipal incineration
polyolefines (i.a. pe,pp) (i.a. pipes, foils) (NMD ID 57)	Recycling	Waste polyethylene, for recycling, sorted {Europe without Switzerland}| treatment of waste polyethylene, for recycling, unsorted, sorting
Steel, light (NMD ID 73)	Recycling	Materials for recycling, no waste processing taken into account
Steel, light (NMD ID 73)	Re-use	Materials for re-use, no waste processing taken into account

* A shortened name for the used process/data set is presented in the report. The full name of the used data set is shown at Annex 10.3

6.4 FINAL DISPOSAL

For final disposal the following process(es) are considered for the different types of final disposal. The applicable amount(s) can be found at chapter 5, where all inventory data is declared.

Waste Scenario	Type of final disposal	Used environmental profile / dataset*
Steel, reinforcement (NMD ID 74)	Landfill	Scrap steel {Europe without Switzerland}| treatment of scrap steel, inert material landfill
polyolefines (i.a. pe,pp) (i.a. pipes, foils) (NMD ID 57)	Landfill	Waste polyethylene {Europe without Switzerland}| treatment of waste polyethylene, sanitary landfill
Steel, light (NMD ID 73)	Landfill	Scrap steel {Europe without Switzerland}| treatment of scrap steel, inert material landfill

6 Waste Scenarios

* A shortened name for the used process/data set is presented in the report. The full name of the used data set is shown at Annex 10.3

6.5 LOADS FROM END-OF-WASTE STATE TO POINT OF SUBSTITUTION

When the substituted process for recycling and/or reuse of primary content goes beyond the end-of-waste point. An additional burden should be taken into account in module D for the difference between the end-of-waste point and the substituted process. When applicable, in the following table the additional process taken into account is declared per waste scenario.

Waste Scenario	Loads from EoW to point of substitution	Used environmental profile / dataset*
Steel, reinforcement (NMD ID 74)	Recycling	
polyolefines (i.a. pe,pp) (i.a. pipes, foils) (NMD ID 57)	Recycling	
Steel, light (NMD ID 73)	Recycling	
Steel, light (NMD ID 73)	Re-use	

* A shortened name for the used process/data set is presented in the report. The full name of the used data set is shown at Annex 10.3

6.6 BENEFITS RECYCLING AND/OR RE-USE

When recycling or reusing a raw material of product a benefit may be taken into account in module D. The following table shows the waste scenario's where recycling is applicable and which process is used as avoided primary equivalent. Also the used Q factor is declared and substantiated.

Waste Scenario	Benefit for	Avoided primary equivalent	Q factor (Qr out / Qsub)	Substantiation Q factor
Steel, reinforcement (NMD ID 74)	Recycling	Benefits module D | World Steel method (Steel production, electric, low-alloyed - Steel production, converter, unalloyed)	1	No loss of quality when recycling the material
polyolefines (i.a. pe,pp) (i.a. pipes, foils) (NMD ID 57)	Recycling	Polyethylene, high-density (HDPE), granulate | production (EU)	0.67	Estimation has been made that recycling is possible with a maximum of 3 cycles, therefore a Q-factor of 2/3 = 0,67 is used.
Steel, light (NMD ID 73)	Recycling	Benefits module D | World Steel method (Steel production, electric, low-alloyed - Steel production, converter, unalloyed)	1	No loss of quality when recycling the material

6 Waste Scenarios

Waste Scenario	Benefit for	Avoided primary equivalent	Q factor (Qr out / Qsub)	Substantiation Q factor
Steel, light (NMD ID 73)	Re-use	Pig iron | production (GLO)	1	No loss of quality when reusing the material

6.7 LOADS SECONDARY MATERIAL LOST

When secondary material used in the product is lost, by landfilling or incineration, a load must be taken into account at module D. At the modules where secondary material is lost the amount and primary equivalent counted as load are declared. In R<THiNK the net output flow is determined by the amount of avoided primary material minus the amount of secondary material lost. The following table shows the Q factor used for secondary material lost and the substantiation.

Waste Scenario	Q factor (Qr out / Qsub)	Substantiation Q factor
Steel, reinforcement (NMD ID 74)	1	Not applicable
Waste mineral oil (100% Incineration)	1	Not applicable
finishes (adhered to wood, plastic, metal) (NMD ID 2)	1	Not applicable
polyolefines (i.a. pe,pp) (i.a. pipes, foils) (NMD ID 57)	1	Not applicable
Steel, light (NMD ID 73)	1	Not applicable

6.8 BENEFITS ENERGY RECOVERY

When waste is used for energy recovery with an overall efficiency that meets the requirements as stated in the EN15804, a benefit may be taken into account in module D. The following table shows the waste scenario where energy recovery is applicable, which energy process is taken into account for avoided energy production and the used electrical en thermal efficiency.

Waste Scenario	Used environmental profile / dataset*
Steel, reinforcement (NMD ID 74)	Not applicable
Waste mineral oil (100% Incineration)	Benefits Energy recovery, fossil based raw material (eff. 18% electric, 31% Thermal) (per MJ LHV)
finishes (adhered to wood, plastic, metal) (NMD ID 2)	Benefits Energy recovery, fossil based raw material (eff. 18% electric, 31% Thermal) (per MJ LHV)
polyolefines (i.a. pe,pp) (i.a. pipes, foils) (NMD ID 57)	Benefits Energy recovery, fossil based raw material (eff. 18% electric, 31% Thermal) (per MJ LHV)
Steel, light (NMD ID 73)	Not applicable

6 Waste Scenarios

* A shortened name for the used process/data set is presented in the report. The full name of the used data set is shown at Annex 10.3

7 Results

For the impact assessment, the characterisation factors of the LCIA method EN 15804 +A2 Method v1.0 are used. Long-term emissions (>100 years) are not considered in the impact assessment. The results of the impact assessment are only relative statements that do not make any statements about end-points of the impact categories, exceedance of threshold values, safety margins or risks. The following tables show the results of the indicators of the impact assessment, of the use of resources as well as of waste and other output flows.

7.1 ENVIRONMENTAL IMPACT INDICATORS PER KILOGRAM

CORE ENVIRONMENTAL IMPACT INDICATORS EN15804+A2

Abbreviation	Unit	A1	A2	A3	C1	C2	C3	C4	D	Total
AP	mol H+ eqv.	2.92E-3	1.92E-4	1.01E-3	0.00E+0	4.11E-5	0.00E+0	2.50E-6	-5.22E-3	-1.05E-3
GWP-total	kg CO2 eqv.	2.54E+0	2.27E-2	2.71E-1	0.00E+0	7.09E-3	0.00E+0	2.64E-4	-1.34E+0	1.50E+0
GWP-b	kg CO2 eqv.	-3.12E-3	1.29E-4	2.83E-3	0.00E+0	3.27E-6	0.00E+0	5.22E-7	1.41E-2	1.39E-2
GWP-f	kg CO2 eqv.	2.54E+0	2.25E-2	2.60E-1	0.00E+0	7.09E-3	0.00E+0	2.63E-4	-1.35E+0	1.48E+0
GWP-luluc	kg CO2 eqv.	3.35E-4	2.67E-5	8.14E-3	0.00E+0	2.60E-6	0.00E+0	7.34E-8	9.99E-4	9.51E-3
EP-m	kg N eqv.	6.15E-3	6.74E-5	3.53E-4	0.00E+0	1.45E-5	0.00E+0	8.60E-7	-9.68E-4	5.62E-3
EP-fw	kg P eqv.	3.49E+0	9.51E-7	9.36E-2	0.00E+0	7.15E-8	0.00E+0	2.95E-9	-4.78E-5	3.58E+0
EP-T	mol N eqv.	1.65E-3	7.47E-4	1.62E-3	0.00E+0	1.60E-4	0.00E+0	9.48E-6	-1.13E-2	-7.12E-3
ODP	kg CFC 11 eqv.	2.00E-15	3.08E-9	8.18E-9	0.00E+0	1.56E-9	0.00E+0	1.08E-10	-3.30E-8	-2.01E-8
POCP	kg NMVOC eqv.	1.28E-7	2.03E-4	3.35E-4	0.00E+0	4.56E-5	0.00E+0	2.75E-6	-7.69E-3	-7.10E-3
ADP-f	MJ	5.06E+0	3.31E-1	1.86E+0	0.00E+0	1.07E-1	0.00E+0	7.36E-3	-9.45E+0	-2.08E+0
ADP-mm	kg Sb-eqv.	2.60E+1	1.81E-7	6.97E-1	0.00E+0	1.80E-7	0.00E+0	2.41E-9	-9.14E-7	2.67E+1
WDP	m3 world eqv.	2.78E-8	2.92E-3	6.38E-1	0.00E+0	3.82E-4	0.00E+0	3.30E-4	-2.58E-1	3.84E-1

AP=Acidification (AP) | **GWP-total**=Global warming potential (GWP-total) | **GWP-b**=Global warming potential - Biogenic (GWP-b) | **GWP-f**=Global warming potential - Fossil (GWP-f) | **GWP-luluc**=Global warming potential - Land use and land use change (GWP-luluc) | **EP-m**=Eutrophication marine (EP-m) | **EP-fw**=Eutrophication, freshwater (EP-fw) | **EP-T**=Eutrophication, terrestrial (EP-T) | **ODP**=Ozone depletion (ODP) | **POCP**=Photochemical ozone formation - human health (POCP) | **ADP-f**=Resource use, fossils (ADP-f) | **ADP-mm**=Resource use, minerals and metals (ADP-mm) | **WDP**=Water use (WDP)

7 Results

ADDITIONAL ENVIRONMENTAL IMPACT INDICATORS EN15084+A2

Abbreviation	Unit	A1	A2	A3	C1	C2	C3	C4	D	Total
ETP-fw	CTUe	3.49E+0	3.54E-1	3.23E+0	0.00E+0	9.53E-2	0.00E+0	4.77E-3	-4.54E+1	-3.82E+1
PM	disease incidence	6.15E-3	1.68E-9	1.65E-4	0.00E+0	6.37E-10	0.00E+0	4.86E-11	-7.83E-8	6.31E-3
HTP-c	CTUh	1.23E-10	2.16E-11	1.03E-9	0.00E+0	3.09E-12	0.00E+0	1.10E-13	-1.75E-10	1.01E-9
HTP-nc	CTUh	1.12E-8	3.96E-10	1.28E-8	0.00E+0	1.04E-10	0.00E+0	3.39E-12	2.62E-7	2.87E-7
IR	kBq U235 eqv.	5.22E-2	1.85E-3	1.62E-2	0.00E+0	4.48E-4	0.00E+0	3.02E-5	2.31E-2	9.39E-2
SQP	Pt	1.64E+0	2.28E-1	8.33E-1	0.00E+0	9.27E-2	0.00E+0	1.54E-2	-2.09E+0	7.20E-1

ETP-fw=Ecotoxicity, freshwater (ETP-fw) | **PM**=Particulate Matter (PM) | **HTP-c**=Human toxicity, cancer (HTP-c) | **HTP-nc**=Human toxicity, non-cancer (HTP-nc) | **IR**=Ionising radiation, human health (IR) | **SQP**=Land use (SQP)

CLASSIFICATION OF DISCLAIMERS TO THE DECLARATION OF CORE AND ADDITIONAL ENVIRONMENTAL IMPACT INDICATORS

ILCD classification	Indicator	Disclaimer
ILCD type / level 1	Global warming potential (GWP)	None
	Depletion potential of the stratospheric ozone layer (ODP)	None
	Potential incidence of disease due to PM emissions (PM)	None
ILCD type / level 2	AAcidification potential, Accumulated Exceedance (AP)	None
	Eutrophication potential, Fraction of nutrients reaching freshwater end compartment (EP-freshwater)	None
	Eutrophication potential, Fraction of nutrients reaching marine end compartment (EP-marine)	None
	Eutrophication potential, Accumulated Exceedance (EP-terrestrial)	None
	Formation potential of tropospheric ozone (POCP)	None
	Potential Human exposure efficiency relative to U235 (IRP)	1
ILCD type / level 3	Abiotic depletion potential for non-fossil resources (ADP-minerals&metals)	2
	Abiotic depletion potential for fossil resources (ADP-fossil)	2
	Water (user) deprivation potential, deprivation-weighted water consumption (WDP)	2
	Potential Comparative Toxic Unit for ecosystems (ETP-fw)	2
	Potential Comparative Toxic Unit for humans (HTP-c)	2

7 Results

ILCD classification	Indicator	Disclaimer
	Potential Comparative Toxic Unit for humans (HTP-nc)	2
	Potential Soil quality index (SQP)	2

Disclaimer 1 – This impact category deals mainly with the eventual impact of low dose ionizing radiation on human health of the nuclear fuel cycle. It does not consider effects due to possible nuclear accidents, occupational exposure nor due to radioactive waste disposal in underground facilities. Potential ionizing radiation from the soil, from radon and from some construction materials is also not measured by this indicator.

Disclaimer 2 – The results of this environmental impact indicator shall be used with care as the uncertainties on these results are high or as there is limited experienced with the indicator.

7.2 INDICATORS DESCRIBING RESOURCE USE AND ENVIRONMENTAL INFORMATION BASED ON LIFE CYCLE INVENTORY (LCI)

PARAMETERS DESCRIBING RESOURCE USE

Abbreviation	Unit	A1	A2	A3	C1	C2	C3	C4	D	Total
PERE	MJ	4.94E-1	2.85E-2	1.63E-1	0.00E+0	1.34E-3	0.00E+0	5.95E-5	2.75E-1	9.61E-1
PERM	MJ	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
PERT	MJ	4.94E-1	2.85E-2	1.63E-1	0.00E+0	1.34E-3	0.00E+0	5.95E-5	2.75E-1	9.61E-1
PENRE	MJ	2.60E+1	3.50E-1	2.44E+0	0.00E+0	1.13E-1	0.00E+0	7.82E-3	-9.81E+0	1.91E+1
PENRM	MJ	0.00E+0	0.00E+0	5.66E-2	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	5.66E-2
PENRT	MJ	2.60E+1	3.50E-1	2.50E+0	0.00E+0	1.13E-1	0.00E+0	7.82E-3	-9.81E+0	1.92E+1
SM	Kg	1.67E-1	0.00E+0	5.16E-3	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	1.72E-1
RSF	MJ	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
NRSF	MJ	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
FW	M3	1.19E-1	1.55E-4	1.84E-2	0.00E+0	1.30E-5	0.00E+0	7.86E-6	-4.89E-3	1.33E-1

PERE=renewable primary energy ex. raw materials | **PERM**=renewable primary energy used as raw materials | **PERT**=renewable primary energy total | **PENRE**=non-renewable primary energy ex. raw materials | **PENRM**=non-renewable primary energy used as raw materials | **PENRT**=non-renewable primary energy total | **SM**=use of secondary material | **RSF**=use of renewable secondary fuels | **NRSF**=use of non-renewable secondary fuels | **FW**=use of net fresh water

7 Results

OTHER ENVIRONMENTAL INFORMATION DESCRIBING WASTE CATEGORIES

Abbreviation	Unit	A1	A2	A3	C1	C2	C3	C4	D	Total
HWD	Kg	1.92E-9	6.42E-7	4.27E-6	0.00E+0	2.71E-7	0.00E+0	1.10E-8	-1.62E-4	-1.57E-4
NHWD	Kg	2.36E-1	4.46E-3	1.01E-1	0.00E+0	6.78E-3	0.00E+0	5.00E-2	-1.32E-1	2.66E-1
RWD	Kg	6.56E-4	2.03E-6	3.01E-5	0.00E+0	7.02E-7	0.00E+0	4.83E-8	8.01E-6	6.97E-4

HWD=hazardous waste disposed | **NHWD**=non hazardous waste disposed | **RWD**=radioactive waste disposed

ENVIRONMENTAL INFORMATION DESCRIBING OUTPUT FLOWS

Abbreviation	Unit	A1	A2	A3	C1	C2	C3	C4	D	Total
CRU	Kg	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
MFR	Kg	4.52E-4	0.00E+0	2.55E-2	0.00E+0	0.00E+0	9.50E-1	0.00E+0	0.00E+0	9.76E-1
MER	Kg	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
EET	MJ	0.00E+0	0.00E+0	1.40E-2	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	1.40E-2
EEE	MJ	0.00E+0	0.00E+0	8.12E-3	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	8.12E-3

CRU=Components for re-use | **MFR**=Materials for recycling | **MER**=Materials for energy recovery | **EET**=Exported Energy Thermic | **EEE**=Exported Energy Electric

7 Results

7.3 INFORMATION ON BIOGENIC CARBON CONTENT PER KILOGRAM

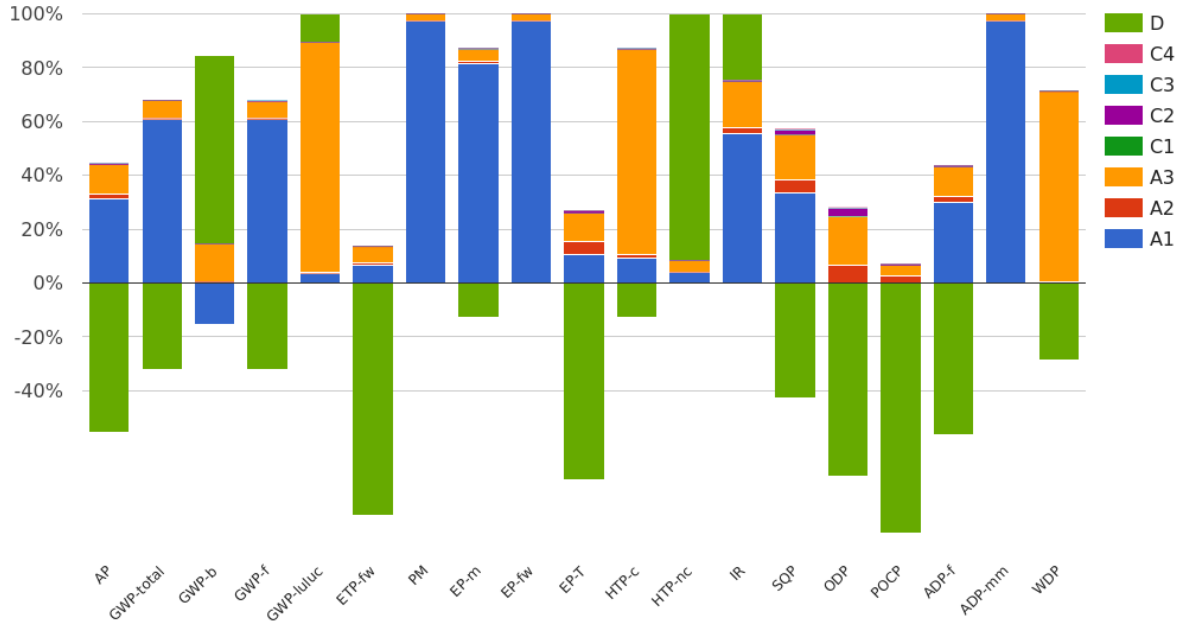
BIOGENIC CARBON CONTENT

The following Information describes the biogenic carbon content in (the main parts of) the product at the factory gate per kilogram:

Biogenic carbon content	Amount	Unit
Biogenic carbon content in the product	0	kg C
Biogenic carbon content in accompanying packaging	0	kg C

8 Interpretation of results

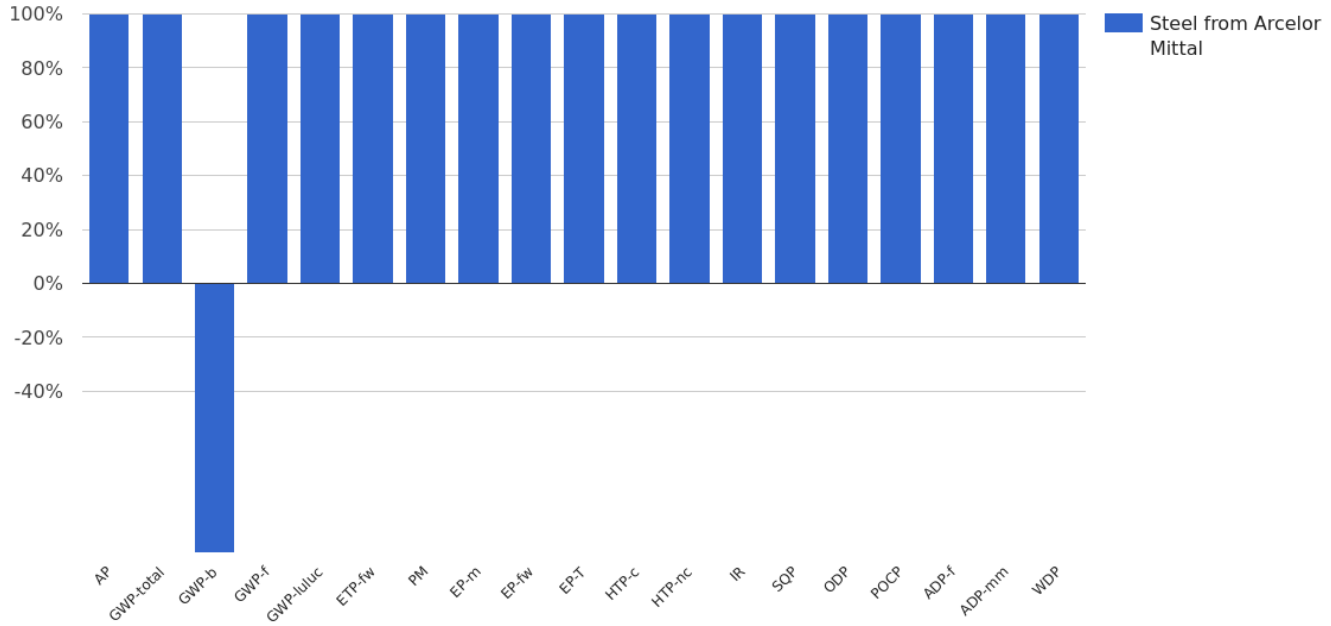
8.1 CONTRIBUTION ANALYSIS OF THE MODULES



The graph illustrates the impact of various factors on the x-axis, representing different indicator factors, while the legends denote the modules on the y-axis. With A1 having the most impact and D having the most balancing impact. The main impact is from A1 as the main input is Raw material and there are some small processes happening which has not so much impact.

8 Interpretation of results

8.2 CONTRIBUTION ANALYSIS OF THE RAW MATERIALS (A1)

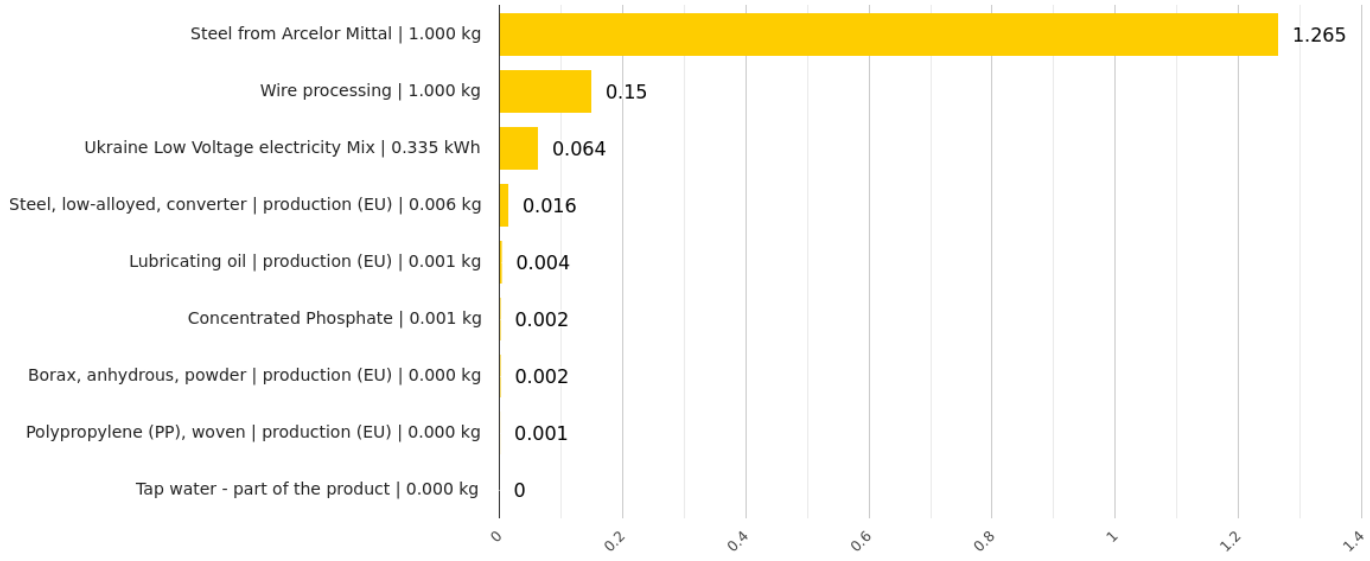


As Steel is the only Raw material so this has not so much relevance.

8 Interpretation of results

8.3 CONTRIBUTION ANALYSIS OF THE INPUTS

The following diagram shows the contribution of the inputs, expressed in the Global warming potential - total. The results per input are the sum of all declared modules including module D.



9 Sensitivity analysis

10 Data collection details

10.1 DATA QUALITY OF THE LIFECYCLE INVENTORY DATA

Description	Determination matter	Data source
Raw material(s)		
Arcelor Mittal	measured	Stalkanat
Ancillary materials		
Water	measured	Stalkanat
Drawing Lubricant	measured	Stalkanat
Phosphate Concentrate	measured	Stalkanat
Borax	measured	Stalkanat
Packaging material(s)		
Polypropylene	measured	Stalkanat
Metal Tape	measured	Stalkanat
Energy consumption		
Energy	measured	Stalkanat
Production emissions		
Wire Drawing Emmission	measured	Stalkanat

10.2 APPROACH OF SUPPLIERS FOR LCA DATA

Supplier	supplier approached for company-specific environmental data?	Manner in which the supplier is approached	Received document type
Arcelor Mittal	yes	by letter/email	
ODETEX	no		
Pan Chemicals S.p.A.	no		
Nanjing Leading Chemical Co., Ltd.	no		
BEKAP METAL İNŞAAT SAN. VE TİC. A.Ş	no		

10 Data collection details

10.3 USED PROCESSES

Shortened name in report	Processes used	Source	Third-party verified	Valid until	Comments
Steel from Arcelor Mittal	n.a	EcoInvent 3.6 (2019)	no		
Ukraine Low Voltage electricity Mix	n.a.	EcoInvent 3.6 (2019)	no		
Tap water - part of the product	Tap water {RER}| market group for | Cut-off, U	EcoInvent 3.6 (2019)	no		
Lubricating oil | production (EU)	Lubricating oil {RER}| production | Cut-off, U	EcoInvent 3.6 (2019)	no		
Concentrated Phosphate	n.a	EcoInvent 3.6 (2019)	no		
Borax, anhydrous, powder | production (EU)	Borax, anhydrous, powder {RER}| production | Cut-off, U	EcoInvent 3.6 (2019)	no		
Polypropylene (PP), woven | production (EU)	NIBE Polypropylene (PP), woven | production (RER)	NIBE/ EcoInvent 3.6 (2019)	no		The material itself is Polypropylene, granulate {RER}| production. For the drawing of polyester threads, the process extrusion foil is considered the most representative. For the weaving process, Weaving bast fibre has been used.
Steel, low-alloyed, converter | production (EU)	Steel, low-alloyed {RER}| steel production, converter, low-alloyed | Cut-off, U	EcoInvent 3.6 (2019)	no		
Wire processing	n.a	EcoInvent 3.6 (2019)	no		

11 References

ISO 14040
ISO 14040:2006-10, Environmental management - Life cycle assessment - Principles and framework; EN ISO 14040:2006

ISO 14044
ISO 14044:2006-10, Environmental management - Life cycle assessment - Requirements and guidelines; EN ISO 14040:2006

ISO 14025
ISO 14025:2011-10: Environmental labels and declarations — Type III environmental declarations — Principles and procedures

EN 15804+A2
EN 15804+A2: 2019: Sustainability of construction works — Environmental Product Declarations — Core rules for the product category of construction products

General PCR Ecobility Experts
Kiwa-Ecobility Expert PCR B for construction steel products