ZAG EPD

Environmental Product Declaration

According to ISO 14025 and EN 15804

SIQUAL 7225 and SIDUR 8715B steel

EPD number	EPD-19/0002
EPD number at ECO-Platform	00000952
EPD owner	SIJ Acroni, podjetje za proizvodnjo jekla in jeklenih izdelkov, d.o.o., Cesta Borisa Kidriča 44, 4270 Jesenice
EPD Program operator	ZAG EPD
Issue date	28.06. 2019
Valid until	27. 06. 2024

ECO PLATFORM EPD EN 15804 VERIFIED

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General information

Commercial name

SIQUAL 7225 and SIDUR 8715B

Program holder:
Slovenian National Building And Civil Engineering Institute - ZAG
Dimičeva 12
1000 Ljubljana
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Owner of the Environmental Product Declaration:
SIJ Acroni, podjetje za proizvodnjo jekla in jeklenih izdelkov, d.o.o.
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https://sij.acroni.si

Number of the Environmental Product Declaration:

EPD-19/0002

Declared unit:

1t of SIQUAL 7225 or SIDUR 8715B steel

This Environmental Product Declaration is based on the Product Category Rules (PCR):

Part B: Requirements on the EPD for Structural steels, 2012, Institut Bauen und Umwelt e.V.

Scope:

A1-A3 + D

Issue date: 28.06.2019

Valid until: 27.06.2024

Production plant:

SIJ Acroni, podjetje za proizvodnjo jekla in jeklenih izdelkov, d.o.o.
Cesta Borisa Kidriča 44
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Verification:

The CEN standard SIST EN 15804 serves as the core Product Category Rule (PCR)	
Independent verification of the EPD according to EN ISO 14025	
☒ internal	☐ external

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1 Product

1.1 Product description

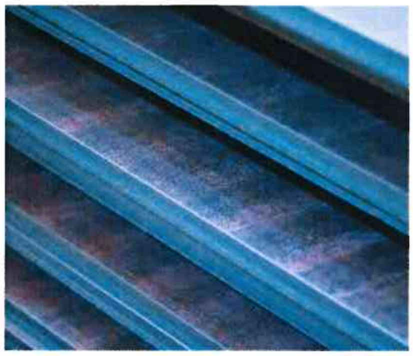
SIQUAL and SIDUR represent a family of hot-rolled steel sheets of rectangular format, which are available in different dimensions and are manufactured according to EN standards. SIQUAL and SIDUR steels are used for products where load-bearing and wear resistance are important. The SIQUAL and SIDUR steel brands belong to the group of carbon steels. SIDUR steels are manufactured according to the technical specifications of Datasheet SIDUR 400, Datasheet SIDUR 450, Datasheet SIDUR 500 and Datasheet SIDUR 600. SIQUAL steels are manufactured according to the standards EN 10132-3, EN 10083-3 and ASTM A829. SIDUR steels, as wear resistant steels, and SIQUAL steels, as non-alloy structural steels, are resistant to atmospheric corrosion and can be used for production of springs and pressure vessels, as well as tempering steel.

1.2 Technical Data

Mechanical properties (Rp0,2) range from 200 to 300 MPa in austenitic and ferritic stainless steels, duplex steels exceed 450 MPa, while martensitic steels exceed 700 MPa.

SIQUAL and SIDUR steels are corrosion resistant to atmospheric corrosion and seawater, as well as to other more aggressive media.

Table 1: Overview of SIQUAL 7225 and SIDUR 8715B steels and their properties

Commercial name	Technical data	Product photo
SIQUAL 7225	Thickness: 2 – 120 mm Width: 1000 – 2500 mm Length: 2000 – 12000 mm	
SIDUR 8715B	Thickness: 2 – 120 mm Width: 1000 – 2500 mm Length: 2000 – 12000 mm	

1.3 Base materials

The basic materials for the production of SIQUAL and SIDUR steels are:

- Iron scrap 90 – 97%
- Pig iron 0 – 7,5%
- Aluminium (bars, chips) 0,28%
- Ferrochrome carbure 0,47 – 1%
- Ferromanganese carbure 0,38 – 0,76%
- Ferromolybdenum 0,2 – 0,25%
- Ferrosilicon 0,24 – 0,85%
- Silicomanganese 0 – 0,61%
- Ferroboron wire 0 – 0,02%
- Ferrotitanium wire 0 – 04%
- Calcium-Silicon wire 0,03%
- Aluminium wire 0 – 0,03%

In addition to iron scrap, metallic and non-metallic additives are used for the production of SIQUAL and SIDUR steels.

1.4 Manufacturing process

The technological pathway of the steel production depends on the type of steel and its physical, chemical and other properties. The basic raw material for steelmaking is iron scrap. The iron scrap is obtained from discarded material from manufacturing industry and unusable old equipment, which in turn enables economically viable recycling of valuable alloys of the steel industry.

The smelting process is carried out in an electric arc furnace (EAF). The steel melt is poured out of the oven into a ladle and is transferred to the Vacuum Oxygen Degassing (VOD) / Vacuum Degassing (VD) processing unit or Argon Oxygen Decarburisation (AOD) converter. The ladle furnace (LF) is used to heat the steel melt during the treatment at VOD in order to hold the steel melt at the desired temperature and to prevent an excessive drop in the steel melt temperature. The melted steel from the ladle furnace is then cast in the continuous casting process. The continuous cast is cut with a flame cutter to a suitable length (i.e. slab). The slabs are properly marked (quality, batch number, serial number and casting position), and their surface is cleaned in order to remove any insufficiencies that may have emerged on the surface of the slabs during the casting process. The prepared slabs are then transported to the hot rolling mill.

In the hot rolling mill, the slabs from the steel mill are hot processed in a metal forming process called rolling. The pusher type furnace (PF) is used to heat the slabs to the temperature required for hot rolling (up to 1300°C), with the pusher type furnace being gas-fired. The slabs are stashed in the PF in one-line (for further cold processing) or two-line (for thick sheet production) configuration. Once the slabs are heated to the temperature required for hot rolling, they are pushed out of the furnace onto a pull-out device. This device is used to place the slabs on the transport rollers. The slabs then go through the process of primary descaling (i.e. water descaling), where scale is removed from the surface of the heated slags by blasting the surface with pressurized water. This is followed by the process of hot rolling in the plate mill. The plate mill is used for either hot rolling of slabs into a bar 12 to 20 mm thick, or for the final hot rolling of a thick sheet with thickness ranging from 8 to 120 mm.

The technological pathway of the thick metal sheet production continues at the thick metal sheet processing production unit, which is located at Javornik. The metal sheets are transported from the hot rolling mill to the primary warehouse, where the metal sheets are further distributed to different aggregates depending on the type of steel, the thickness of the sheet and the customer requirements. The production process is therefore mainly a gradual procedure, which takes place in phases and requires storing in intermediate warehouses. The thick metal sheet heat treatments are carried out at different heat treatment furnaces. After the adequate heat treatment, the metal sheets are cut and trimmed with the mechanical cutter for the front and side trimming, the autogenous flame cutter for the front and side trimming and the plasma cutter for the front and side trimming. The cutting and trimming process is followed by the surface treatment of the metal sheet plates. All stainless steel sheets are sandblasted at the sandblasting line. Depending on the customer requirements, other types of steel sheets (ordinary, alloyed etc.) can be sandblasted as well. After sandblasting, the final adjustments and inspection of plates is performed. Finally, the plates are shipped out to the customers.

Figure 1: Schematic representation of the SIQUAL and SIDUR steel production process

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1.5 Packaging

The following materials have been used for the packaging of the final product:

- wooden laths
- paper
- Polyethylene (PE) foil
- packaging tape

1.6 Further information

Further information about SIQUAL and SIDUR steel brands is available on the manufacturer web page:

https://sij.acroni.si/en/

2 LCA: Calculation rules

2.1 Declared unit

The declared unit has been defined in accordance with the Product Category Rules (PCR) Part B: Requirements on the EPD for Structural steels, which has been issued by the by the Institut Bauen und Umwelt e.V. (IBU). The following declared unit has been applied:

1t of SIQUAL 7225 or SIDUR 8715B steel

2.2 System boundary

The system boundaries have been defined in accordance with the modular principle described in the European standard for Environmental Product Declarations (EPD) EN 15804. This LCA study is based on the cradle to gate with options principle and includes modules A1-A3 and module D. The LCA covers the following life cycle stages:

A1: raw material extraction and processing, processing of secondary material input (e.g. recycling processes);

A2: transport to the manufacturer;

A3: manufacturing;

including provision of all materials, products and related energy and water use.

D: reuse, recovery and/or recycling potentials, expressed as net impacts and benefits.

2.3 Cut-off rules

In accordance with standard EN 15804, the amount of the missing data can be less than 1% of renewable and non-renewable primary energy usage, less than 1% of the total mass input of each production process, and less than 5% of energy usage and total mass in module A.

The LCA analysis included data on basic raw materials, ancillary materials, packaging materials, transportation and energy in the manufacturing process, which has been provided by the manufacturer. All available data has been included in the model.

2.4 Background data

The LCA analysis of SIQUAL 7225 and SIDUR 8715B steels has been conducted with the GaBi 6 modelling software, which has been developed by PE International in collaboration with the University of Stuttgart. All processes have been modelled based on the inventory data given in the Ecoinvent integrated 3.4 database.

2.5 Data quality

The time period for which the data has been collected is 2018. The LCA analysis includes all input data, such as basic raw materials, auxiliary materials, transport, energy and water in the production process. The data has been provided by the manufacturer.

2.6 Period under review

The reference year for data collection is 2018.

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2.7 Allocation

The mass allocation has been used to partition the consumption of ancillary materials and energy requirements between different products within the production process.

3 LCA: Results

Table 2: The selected phases of the LCA study

SYSTEM BOUNDARY																
PRODUCT STAGE			CONSTRUCTION PROCESS STAGE		USE STAGE							END OF LIFE STAGE				BENEFITS AND LOADS BEYOND THE SYSTEM BOUNDARY
Raw material supply	Transport	Manufacturing	Transport	Construction-installation process	Use	Maintenance	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	De-construction demolition	Transport	Waste processing	Disposal	Reuse-Recovery-Recycling potential
A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
☒	☒	☒	MNA	MNA	MNA	MNA	MNA	MNA	MNA	MNA	MNA	MNA	MNA	MNA	MNA	☒
The modules of the product lifecycle, which are included in EPD are marked by "**X**", modules not included are marked with a "**MNA**" = module not assessed																

3.1 Indicators of environmental impacts

According to the standard EN 15804, the environmental impacts are presented with seven indicators (see Table 3).

Table 3: Abbreviations and units of indicators of environmental impacts

Indicators of environmental impacts	Abbreviation	Unit
global warming potential	GWP	kg CO_2 eq.
ozone decomposition potential	ODP	kg CFC 11 eq.
acidification of soil and water	AP	kg SO_2 eq.
eutrophication	EP	kg $(PO_4)^{3-}$ eq.
photochemical ozone creation potential	POCP	kg Ethene eq.
use of abiotic (natural) resources - raw materials	ADP el.	kg Sb eq.
use of abiotic resources - fossil fuels	ADP fos.	MJ, net calorific value

The environmental impact indicators are shown in Table 4.

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Table 4: Indicators of environmental impacts for SIQUAL 7225 and SIDUR 8715B steels

		A1 – A3		D	
Indicator	**Unit**	**SIQUAL 7225**	**SIDUR 8715B**	**SIQUAL 7225**	**SIDUR 8715B**
ADP el.	[kg Sb eq.]	6,22E-03	3,34E-03	-2,45E-06	-1,66E-06
ADP fos.	[MJ]	1,40E+04	1,85E+04	-1,14E+03	-7,70E+02
AP	[kg SO_2 eq.]	3,00E+00	5,38E+00	-4,73E-01	-3,20E-01
EP	[kg $(PO_4)^{3-}$ eq.]	6,41E-01	5,51E-01	-1,64E-01	-1,11E-01
GWP	[kg CO_2 eq.]	8,27E+02	1,31E+03	-1,12E+02	-7,61E+01
ODP	[kg CFC 11 eq.]	1,45E-05	4,95E-06	-5,39E-06	-3,65E-06
POCP	[kg Ethene eq.]	3,68E-01	4,20E-01	-1,28E-01	-8,67E-02

3.2 Indicators of raw material use

The results of the raw materials use are in accordance with the standard EN 15804, shown with ten indicators (see Table 5). Indicators include the use of renewable and non-renewable energy, the use of renewable and non-renewable material resources and the use of water.

Table 5: Abbreviations and units of indicators of raw material use

Indicators of raw material use	**Abbreviation**	**Unit**
use of renewable primary energy, excluding raw material	PERE	MJ, net calorific value
use of renewable primary energy, including raw material	PERM	MJ, net calorific value
sharing of renewable primary energy	PERT	MJ, net calorific value
use of non-renewable primary energy, excluding raw materials	PENRE	MJ, net calorific value
use of non-renewable primary energy sources, including raw materials	PENRM	MJ, net calorific value
sharing of primary non-renewable energy	PENRT	MJ, net calorific value
use of secondary materials	SM	kg
use of renewable secondary fuels	RSF	MJ, net calorific value
use of non-renewable secondary fuels	NRSF	MJ, net calorific value
use fresh drinking water	FW	kg

The indicators of the use of raw materials are shown in Table 6.

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Table 6: Indicators of raw material use for SIQUAL 7225 and SIDUR 8715B steels

		A1-A3		D	
Indicator	**Unit**	**SIQUAL 7225**	**SIDUR 8715B**	**SIQUAL 7225**	**SIDUR 8715B**
PERE	[MJ]	4,13E+03	5,56E+03	-1,86E+01	-1,26E+01
PERM	[MJ]	0,00E+00	0,00E+00	0,00E+00	0,00E+00
PENRT	[MJ]	1,89E+04	2,39E+04	-1,20E+03	-8,15E+02
PENRE	[MJ]	1,89E+04	2,39E+04	-1,20E+03	-815E+02
PENRM	[MJ]	0,00E+00	0,00E+00	0,00E+00	0,00E+00
PERT	[MJ]	4,13E+03	5,56E+03	-1,86E+01	-1,26E+01
SM	[kg]	0,00E+00	0,00E+00	0,00E+00	0,00E+00
RSF	[MJ]	0,00E+00	0,00E+00	0,00E+00	0,00E+00
NRSF	[MJ]	0,00E+00	0,00E+00	0,00E+00	0,00E+00
FW	[kg]	8,65E+03	1,23E+04	-1,84E+02	-1,25E+02

3.3 Other indicators of environmental impacts

According to the standard EN 15804, the results for other environmental information (waste disposal data) are presented with three indicators, and the results of the output flows from the system are based on four indicators (see Table 7).

Table 7: Abbreviations and units of other indicators of environmental impacts

Indicators for other environmental information	**Abbreviation**	**Units**
disposal of hazardous waste	HWD	kg
disposal of non-hazardous waste	NHWD	kg
disposal of radioactive waste	RWD	kg
Output flow indicators	**Abbreviation**	**Units**
constituents suitable for re-use	CRU	kg
constituents suitable for re-use	MFR	kg
materials for renewable energy	MER	kg
energy emitted	EE	MJ on the energy carrier

Indicators for other environmental information and output flow indicators are shown in Table 8.

Table 8: Other indicators of environmental impacts for SIQUAL 7225 and SIDUR 8715B steels

		A1-A3		D	
Indicator	**Unit**	**SIQUAL 7225**	**SIDUR 8715B**	**SIQUAL 7225**	**SIDUR 8715B**
HWD	[kg]	3,46E-05	4,66E-05	0,00E+00	0,00E+00
NHWD	[kg]	8,09E+00	7,13E+01	0,00E+00	0,00E+00
RWD	[kg]	1,36E+00	1,50E+00	0,00E+00	0,00E+00
CRU	[kg]	0,00E+00	0,00E+00	0,00E+00	0,00E+00
MFR	[kg]	0,00E+00	0,00E+00	0,00E+00	0,00E+00
MER	[kg]	0,00E+00	0,00E+00	0,00E+00	0,00E+00
EE	[MJ]	0,00E+00	0,00E+00	0,00E+00	0,00E+00

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4 Interpretation of results

SIQUAL 7225 (A1-A3)

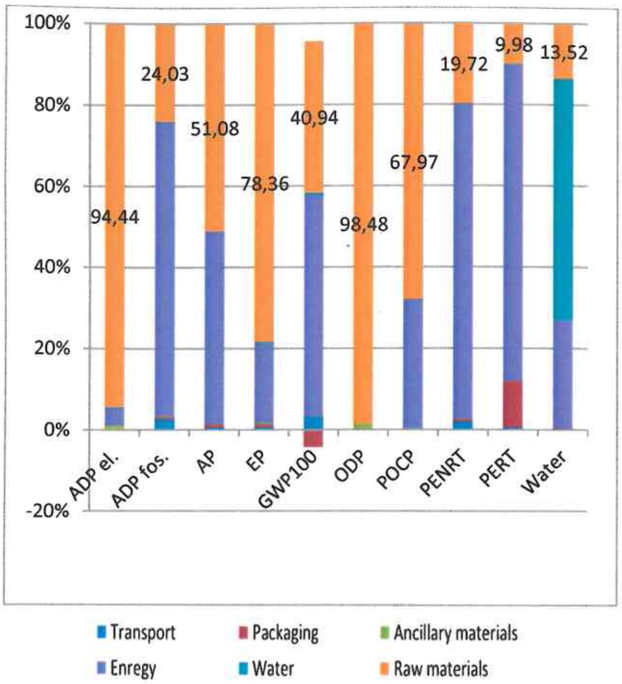

Figure 2: Contribution analysis for product stage of SIQUAL 7225 steel

Interpretation of results by component:

ADP el.: the greatest impact in terms of the depletion of elementary sources presents the use of ferrochrome (84% of the total impact), which is followed by the use of iron scrap (8% of the total impact) and the electricity requirements (3% of the total impact)

ADP fos.: the greatest impact in terms of the depletion of fossil fuels present the natural gas requirements (44% of the total impact), which are followed by the electricity requirements (25% of the total impact) and the use of pig iron (12% of the total impact)

AP: the greatest impact in terms of the acidification present the electricity requirements (41% of the total impact), which are followed by the use of pig iron (25% of the total impact), and ferrochrome and iron scrap (8% of the total impact)

EP: the greatest impact in terms of the eutrophication presents the production of pig iron (40% of the total impact), which is followed by the use of iron scrap (19% of the total impact) and the electricity requirements (16% of the total impact)

GWP: the greatest impact in terms of the increase in the global warming potential present the electricity requirements (43% of the total impact), which are followed by the use of pig iron (20% of the total impact), the natural gas requirements 11% of the total impact) and the use of metallurgical lime (7% of the total impact)

ODP: the greatest impact in terms of the ozone depletion potential presents the use of pig iron (60% of the total impact), which is followed by the use of iron scrap (24% of the total impact) and ferrochrome (8% of the total impact)

POCP: the greatest impact in terms of the photochemical ozone creation potential presents the production of pig iron (52% of the total impact), which is followed by the electricity requirements (19% of the total impact), the natural gas requirements (11% of the total impact) and the production of ferrochrome (5% of the total impact)

PENRT: the greatest impact in terms of the use of the primary non-renewable energy present the electricity requirements (38% of the total impact), which are followed by the natural gas requirements (36% of the total impact) and the use of pig iron (10% of the total impact)

PERT: the greatest impact in terms of the use of the primary renewable energy present the electricity requirements (72% of the total impact), which are followed by the use of wooden laths (11% of the total impact) and the use of oxygen (4% of the total impact)

FW: the greatest impact in terms of the fresh water use presents the use of cooling and service water (47% of the total impact), which is followed by the electricity requirements (24% of the total impact) and the use of process water (13% of the total impact)

SIQUAL 7225 (D)

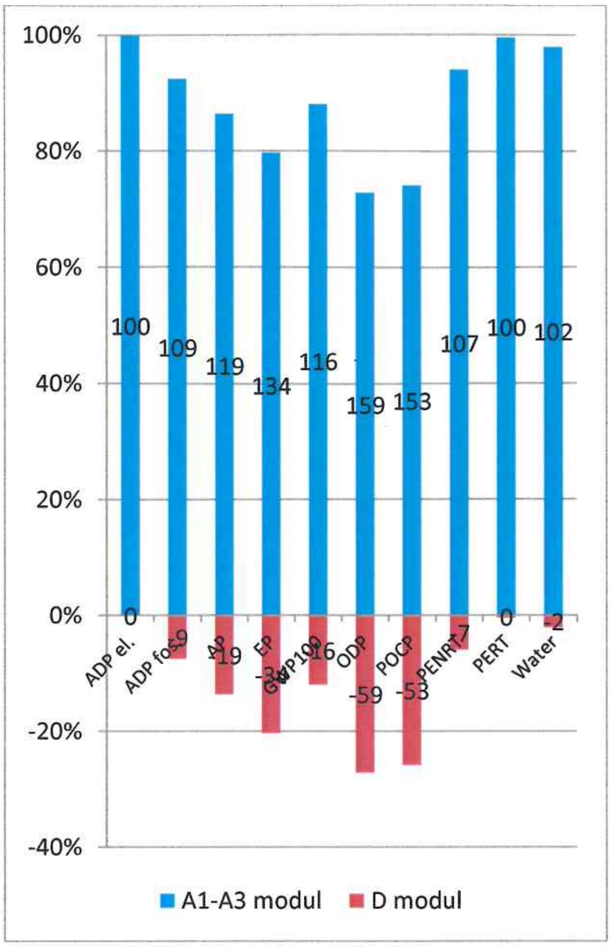

Figure 3: The relative contribution of the product stage (i.e. modules A1-A3) and the benefits and loads beyond the system boundary stage (i.e. module D) of SIQUAL 7225 steel

D module – the benefits and loads beyond the system boundary stage – is expressed as the potential environmental benefit due to the replacement of a virgin material with a secondary material. In the steel production process, the pig iron (virgin material) can be replaced with iron scrap (secondary material).

SIQUAL 7225 steel consists of 83,5% of iron scrap. On average, 90% of steel is recycled at the end-of-life stage (source: Briefing: Reuse and recycling rates of UK steel demolition arising). Therefore, the amount of the pig iron that can be replaced with a secondary material in the future steel production process is equal to the difference between the amount of the recycled content (900 kg for SIQUAL 7225) and the amount of iron scrap in the produced steel (835 kg for SIQUAL 7225), i.e. 65 kg for SIQUAL 7225. In addition, module D also takes into account all environmental impacts associated with the iron scrap recycling process.

The summary of both processes (i.e. material replacement and recycling treatment processes) is generally negative for SIQUAL 7225 steel (see Figure 3), which means that there is a potential environmental benefit due to the replacement of pig iron with iron scrap in the steel production process. Namely, the negative values for module D that can be seen in Figure 3 indicate the potential reduction of the environmental burden in terms of an individual impact category due to the replacement of virgin material (pig iron) with secondary material (iron scrap) in the steel production process.

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SIDUR 8715B (A1-A3)

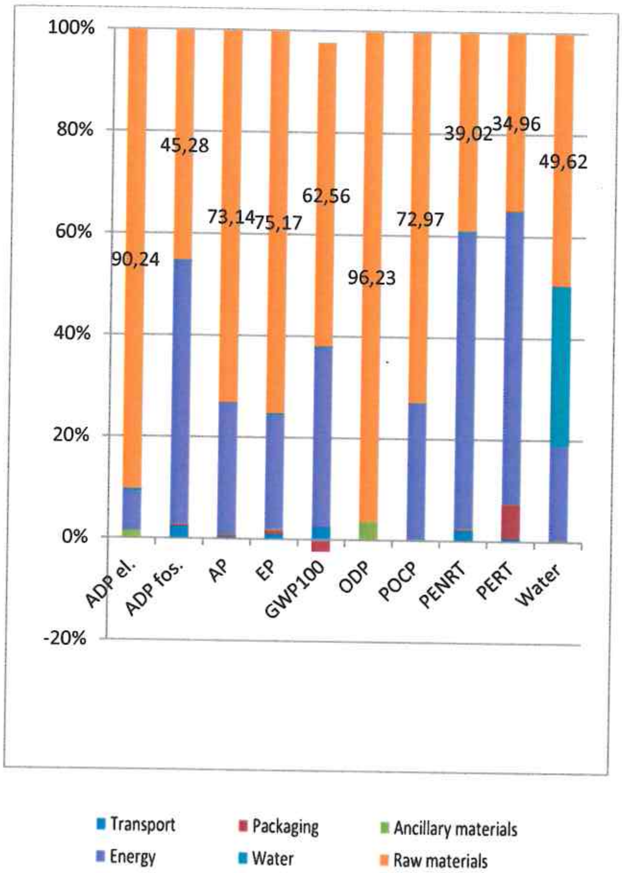

Figure 4: Contribution analysis for product stage of SIDUR 8715B steel

Interpretation of results by component:

ADP el.: the greatest impact in terms of the depletion of elementary sources presents the use of ferrochrome (71% of the total impact), which is followed by the use of iron scrap (16% of the total impact)

ADP fos.: the greatest impact in terms of the depletion of fossil fuels presents the use of ferrosilicon (38% of the total impact), which is followed by the natural gas requirements (30% of the total impact) and the electricity requirements (18% of the total impact)

AP: the greatest impact in terms of the acidification presents the production of ferrosilicon (64% of the total impact), which is followed by the electricity requirements (22% of the total impact) and the use of iron scrap (5% of the total impact)

EP: the greatest impact in terms of the eutrophication presents the production of ferrosilicon (41% of the total impact), the use of iron scrap (23% of the total impact), the electricity requirements (19% of the total impact) and the production of ferrochrome (5% of the total impact)

GWP: the greatest impact in terms of the increase in the global warming potential presents the use of ferrosilicon (53% of the total impact), which is followed by the electricity requirements (27% of the total impact), the natural gas requirements (6% of the total impact) and the use of metallurgical lime (5% of the total impact)

ODP: the greatest impact in terms of the ozone depletion potential presents the use of iron scrap (74% of the total impact), which is followed by the use of ferrochrome (10% of the total impact) and ferromanganese (8% of the total impact)

POCP: the greatest impact in terms of the photochemical ozone creation potential presents the production of ferrosilicon (64% of the total impact), which is followed by the electricity requirements (17% of the total impact), the natural gas requirements (9% of the total impact) and the use of iron scrap (5% of the total impact)

PENRT: the greatest impact in terms of the use of the primary non-renewable energy presents the use of ferrosilicon (33% of the total impact), which is followed by the electricity requirements (29% of the total impact) and the natural gas requirements (26% of the total impact)

PERT: the greatest impact in terms of the use of the primary renewable energy present the electricity requirements (53% of the total impact), which are followed by the use of ferrosilicon (31% of the total impact) and wooden laths (7% of the total impact)

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FW: the greatest impact in terms of the fresh water use presents the use of ferrosilicon (46% of the total impact), which is followed by the use of cooling and service water (17% of the total impact) and process water (9% of the total impact)

SIDUR 8715B 4307 (D)

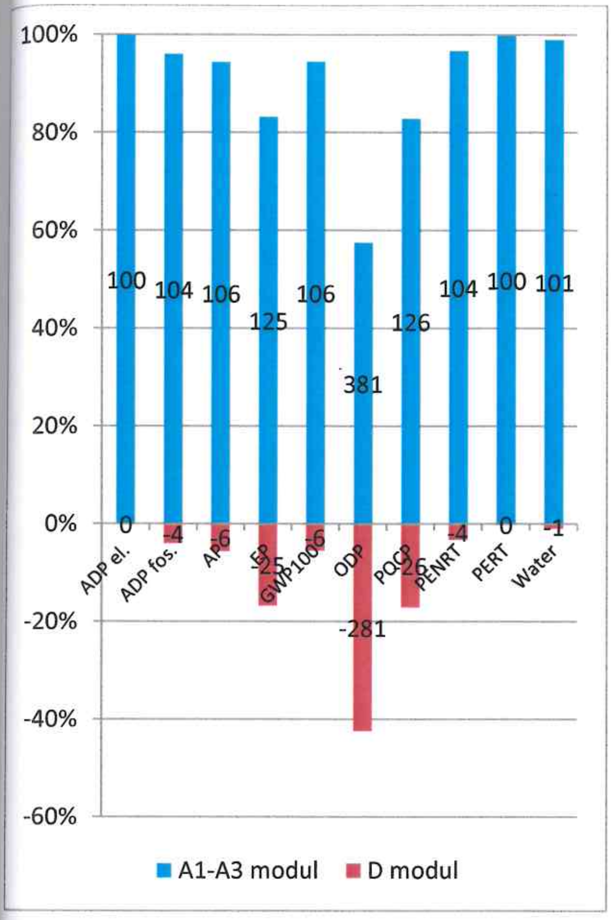

Figure 5: The relative contribution of the product stage (i.e. modules A1-A3) and the benefits and loads beyond the system boundary stage (i.e. module D) of SIDUR 8715B steel

D module – the benefits and loads beyond the system boundary stage – is expressed as the potential environmental benefit due to the replacement of a virgin material with a secondary material. In the steel production process, the pig iron (virgin material) can be replaced with iron scrap (secondary material).

SIDUR 8715B steel consists of 85,6% of iron scrap. On average, 90% of steel is recycled at the end-of-life stage (source: Briefing: Reuse and recycling rates of UK steel demolition arising). Therefore, the amount of the pig iron that can be replaced with a secondary material in the future steel production process is equal to the difference between the amount of the recycled content (900 kg for SIDUR 8715B) and the amount of iron scrap in the produced steel (856 kg for SIDUR 8715B), i.e. 44 kg for SIDUR 8715B. In addition, module D also takes into account all environmental impacts associated with the iron scrap recycling process.

The summary of both processes (i.e. material replacement and recycling treatment processes) is generally negative for SIDUR 8715B steel (see Figure 5), which means that there is a potential environmental benefit due to the replacement of pig iron with iron scrap in the steel production process. Namely, the negative values for module D that can be seen in Figure 5 indicate the potential reduction of the environmental burden in terms of an individual impact category due to the replacement of virgin material (pig iron) with secondary material (iron scrap) in the steel production process.

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5 References

1. GaBi 6 modelling software
2. EN 15804:2012+A1:2013 Sustainability of construction works - Environmental product declarations - Core rules for the product category of construction products
3. EN ISO 14040:2006 Environmental management - Life cycle assessment - Principles and framework
4. EN ISO 14044:2006 Environmental management - Life cycle assessment - Requirements and guidelines
5. EN ISO 14025:2010 Environmental labels and declarations - Type III environmental
6. Report No. 431/18-530-2 date: 28. 06. 2019

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The data specified in the EPD are calculated on the basis of the data provided by the manufacturer. In the event that the manufacturer's information is incorrect, calculations do not apply.