Statement of Verification

BREG EN EPD No.: 000565 Issue 01

This is to verify that the

Environmental Product Declaration

provided by:

Saudi Iron and Steel Company (HADEED)
(Member of CARES)

is in accordance with the requirements of:

EN 15804:2012+A2:2019

and

BRE Global Scheme Document SD207

This declaration is for:

Hot rolled flat steel (Direct Reduced Iron production route)

Company Address

Jubail, 31961
Saudi Arabia

Signed for BRE Global Ltd	Emma Baker Operator	26 February 2024 Date of this Issue
26 February 2024 Date of First Issue		25 February 2027 Expiry Date

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Environmental Product Declaration

EPD Number: 000565

General Information

EPD Programme Operator	Applicable Product Category Rules
BRE Global Watford, Herts WD25 9XX United Kingdom	BRE Environmental Profiles 2013 Product Category Rules for Type III environmental product declaration of construction products to EN 15804+A2 PN 514 Rev 3.1
Commissioner of LCA study	**LCA consultant/Tool**
CARES Pembroke House 21 Pembroke Road Sevenoaks Kent, TN13 1XR UK	CARES EPD Tool SPHERA SOLUTIONS UK LIMITED The Innovation Centre Warwick Technology Park Gallows Hill, Warwick Warwickshire CV34 6UW www.sphera.com
Declared/Functional Unit	**Applicability/Coverage**
The declared unit is 1 tonne of flat steel product manufactured by the Direct Reduced Iron production route.	Manufacturer-specific product.
EPD Type	**Background database**
Cradle to Gate with options	GaBi
Demonstration of Verification	
CEN standard EN 15804 serves as the core PCR [a]	
Independent verification of the declaration and data according to EN ISO 14025:2010 ☐Internal ☒External	
(Where appropriate [b])Third party verifier: Pat Hermon	
a: Product category rules b: Optional for business-to-business communication; mandatory for business-to-consumer communication (see EN ISO 14025:2010, 9.4)	
Comparability	
Environmental product declarations from different programmes may not be comparable if not compliant with EN 15804:2012+A2:2019. Comparability is further dependent on the specific product category rules, system boundaries and allocations, and background data sources. See Clause 5.3 of EN 15804:2012+A2:2019 for further guidance	

Information modules covered

Product			Construction		Use stage							End-of-life					Benefits and loads beyond the system boundary
					Related to the building fabric					Related to the building							
A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4		D
Raw materials supply	Transport	Manufacturing	Transport to site	Construction – Installation	Use	Maintenance	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	Deconstruction demolition	Transport	Waste processing	Disposal		Reuse, Recovery and/or Recycling potential
☑	☑	☑	☐	☐	☐	☐	☐	☐	☐	☐	☐	☑	☑	☑	☑		☑

Note: Ticks indicate the Information Modules declared.

Manufacturing site

Saudi Iron and Steel Company (HADEED) (member of CARES)

Jubail, 31961
Saudi Arabia

Construction Product:

Product Description

Hot Rolled Flat Steels in coils, sheets, plates and other required forms are non-alloy or low-alloy steel products. Hot Rolled Flat Steel Coil (according to product standards listed in Sources of Additional Information) that is obtained from scrap, melted in an Electric Arc Furnace (EAF) followed by hot rolling.

Hot Rolled Flat Steel Coil is produced as a feedstock for cold rolled flat steel coil and coated steel coil, but also for direct use in a variety of industrial applications including construction, hot and cold forming, gas containers, pressure vessels, steel tubes used in transport and energy pipelines.

The declared unit is 1 tonne of hot rolled flat steel coil as used in a variety of industrial applications.

Technical Information

Property	Value, Unit
Production route	EAF
Density	7850 kg/m^3
Modulus of elasticity	210000 N/mm^2
Weldability, Carbon Equivalent (Ceq) EN 10025-2:2004 grades S235JR, S235J0, S235J2, S235JR(Cu), S235JRC, S235J2C+N, S235J2+N, S275JR, S275J0, S275J2, S275JR(Cu), S275JRC, S275J2C+N, S275J2+N, S355JR, S355J0, S355J2, S355JR(Cu), S355JRC, S355J2C+N, S355J2+N (for product thickness≥1.1mm &≤25.4mm)	max 0.35% for S235 grade series max 0.40% for S275 grade series max 0.45% for S355 grade series
Yield Strength EN 10025-2:2004 grades S235JR, S235J0, S235J2, S235JR(Cu), S235JRC, S235J2C+N, S235J2+N, S275JR, S275J0, S275J2, S275JR(Cu), S275JRC, S275J2C+N, S275J2+N, S355JR, S355J0, S355J2, S355JR(Cu), S355JRC, S355J2C+N, S355J2+N (for product thickness ≥1.1mm & <3mm and for thickness ≥3mm & ≤25.4mm)	225 to 235 N/mm^2 for all S235 grade series 265 to 275 N/mm^2 for all S275 grade series 345 to 355 N/mm^2 for all S355 grade series
Tensile Strength EN 10025-2:2004 grades S235JR, S235J0, S235J2, S235JR(Cu), S235JRC, S235J2C+N, S235J2+N, S275JR, S275J0, S275J2, S275JR(Cu), S275JRC, S275J2C+N, S275J2+N, S355JR, S355J0, S355J2, S355JR(Cu), S355JRC, S355J2C+N, S355J2+N (for product thickness ≥1.1mm & <3mm and for thickness ≥3mm & ≤25.4mm)	360 to 510 N/mm2 for S235 grade series 410 to 580 N/mm2 for S275 grade series 470 to 680 N/mm2 for S355 grade series
%Elongation EN 10025-2:2004 grades S235JR, S235J0, S235J2, S235JR(Cu), S235JRC, S235J2C+N, S235J2+N, S275JR, S275J0, S275J2, S275JR(Cu), S275JRC, S275J2C+N, S275J2+N, S355JR, S355J0, S355J2, S355JR(Cu), S355JRC, S355J2C+N, S355J2+N (longitudinal test piece L0=80 mm for thickness 1.1mm & <3mm and longitudinal test piece L0=5.65√S0 mm for thickness ≥3mm & ≤25.4mm)	min 17 to min 26% for S235 grade series min 15 to min 23% for S275 grade series min 14 to min 22% for S355 grade series
Impact Strength KV longitudinal EN 10025-2:2004 grades S235JR, S235J0, S235J2, S235JR(Cu), S235JRC, S235J2C+N, S235J2+N, S275JR, S275J0, S275J2, S275JR(Cu), S275JRC, S275J2C+N, S275J2+N, S355JR, S355J0, S355J2, S355JR(Cu), S355JRC, S355J2C+N, S355J2+N	min 27J at 20˚C for all JR types min 27J at 0˚C for all J0 types min 27J at -20˚C for all J2 types
Recycled content (as per ISO 14021:2016/Amd:2021)	9.8 %

Main Product Contents

Material/Chemical Input	%
Fe	97
C, Mn, Si, V, Ni, Cu, Cr, Mo and others	3

Manufacturing Process

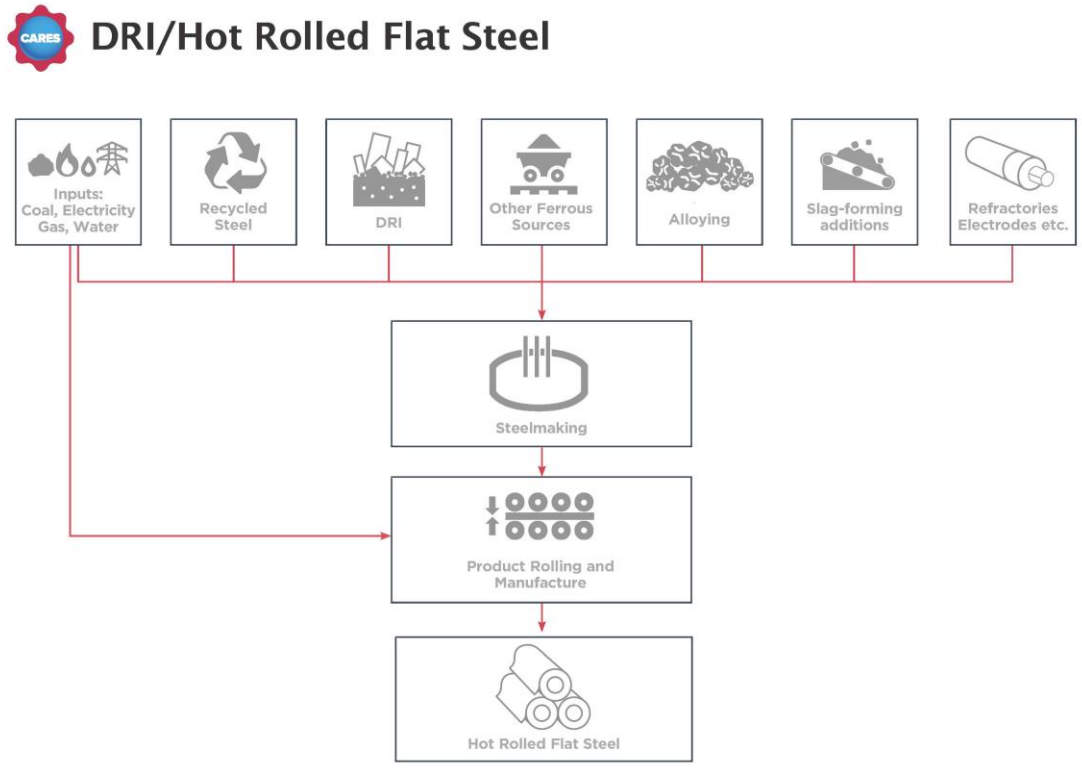
Direct Reduced Iron (DRI) is produced as a first step from imported iron ore pellets. DRI is then melted in an Electric Arc Furnace (EAF) to obtain liquid steel. This is then refined to remove impurities and alloying additions can be added to give the required properties of the steel.

Hot metal (molten steel) from the EAF is then cast into steel billets before being sent to the rolling mill where they are rolled and shaped to the required dimensions for the finished coils of steel feedstock.

Quality assurance and quality control of steel feedstock coil is maintained according to the requirements of ISO 9001 and product standards listed in Sources of Additional Information.

The products are packed with steel wire or straps to bind the products, either of the steel ties and products do not include any biogenic materials.

Process flow diagram



Construction Installation

Processing and proper use of flat steel products depends on the application and should be made in accordance with generally accepted practices, standards and manufacturing recommendations.

During transport and storage of hot rolled flat steel products the usual requirement for securing loads is to be observed.

Use Information

The composition of the hot rolled flat steel products does not change during use.

Hot rolled flat steel products do not cause adverse health effects under normal conditions of use.

No risks to the environment and living organisms are known to result from the mechanical destruction of the reinforcing steel product itself.

End of Life

Hot rolled flat steel products can be reused after dismantling, renovating and demolishing and also can be recycled to the same (or higher/lower) quality of steel depending upon the metallurgy and processing of the recycling route.

It is a high value resource, so efforts are made to recycle steel scrap rather than disposing of it at EoL. A recycling rate of 92% is typical for reinforcing steel products

Life Cycle Assessment Calculation Rules

Declared unit description

The declared unit is 1 tonne of hot rolled flat steel product manufactured by the Direct Reduced Iron production route.

System boundary

The system boundary of the EPD follows the modular design defined by EN 15804+A2. This is a cradle to gate – with options EPD and thus covers modules from A1 to A3, modules from C1 to C4 and module D.

Impacts and aspects related to losses/wastage (i.e. production, transport and waste processing and end-of-life stage of lost waste products and materials) are considered in the modules in which the losses/wastage occur.

Once steel scrap has been collected for recycling it is considered to have reached the end of waste state.

Data sources, quality and allocation

Data Sources: Manufacturing data of the period 01/01/2022-31/12/2022 has been provided by Saudi Iron and Steel Company (HADEED).

The selection of the background data for electricity generation is in line with the BRE Global PCR. Country or region specific power grid mixes are selected from GaBi 2021 databases (Sphera 2021); thus, consumption grid mix of Saudi Arabia has been selected to suit specific manufacturing location.

Data Quality: Data quality can be described as good. Background data are consistently sourced from the GaBi 2021 databases (Sphera 2021). The primary data collection was thorough, considering all relevant flows and these data have been verified by CARES.

Data quality level and criteria of the UN Environment Global Guidance on LCA database development:

Geographical Representativeness	: Good
Technical Representativeness	: Very good
Time Representativeness	: Good

Allocation: DRI & HBI Fines are produced as co-products from the DRI manufacturing process. These co-products are internally recycled. EAF slag and mill scale are produced as co-products from the steel manufacturing process. Impacts are allocated between the steel, the slag and the mill scale based on economic value. The revenue generated from both mill scale and EAF slag are 0.02% and 0.24% respectively, and their total is less than 1% in relation to the product based on current market prices, these co-products are of definite value and are freely/readily traded in reality. For this reason, economic allocation has been applied to the processes where these co-products arise.

Production losses of steel during the production process are recycled in a closed loop offsetting the requirement for external scrap. Specific information on allocation within the background data is given in the GaBi datasets documentation (/GaBi 6 2021/)

Cut-off criteria

On the input side all flows entering the system and comprising more than 1% in total mass or contributing more than 1% to primary energy consumption are considered. All inputs used as well as all process-specific waste and process emissions were assessed. For this reason, material streams which were below 1% (by mass) were captured as well. In this manner the cut-off criteria according to the BRE guidelines are fulfilled.

The mass of steel strap used for binding the product is less than 1 % of the total mass of the product.

LCA Results

(MND = module not declared; MNR = module not relevant; INA = indicator not assessed; AGG = aggregated)

Parameters describing environmental impacts									
			GWP-total	GWP-fossil	GWP-biogenic	GWP-luluc	ODP	AP	EP-freshwater
			kg CO_2 eq	kg CO_2 eq	kg CO_2 eq	kg CO_2 eq	kg CFC11 eq	mol H^+ eq	kg $(PO_4)^{3-}$ eq
Product stage	Raw material supply	A1	1.30E+03	1.30E+03	1.92	0.682	3.00E-07	3.49	1.11E-03
	Transport	A2	78.8	78.7	0.097	0.016	8.13E-15	2.94	2.26E-05
	Manufacturing	A3	860	859	1.04	0.284	1.90E-12	6.25	3.29E-04
	Total (of product stage)	A1-3	2.24E+03	2.24E+03	3.06	0.982	3.00E-07	12.7	1.46E-03
Construction process stage	Transport	A4	MND	MND	MND	MND	MND	MND	MND
	Construction	A5	MND	MND	MND	MND	MND	MND	MND
Use stage	Use	B1	MND	MND	MND	MND	MND	MND	MND
	Maintenance	B2	MND	MND	MND	MND	MND	MND	MND
	Repair	B3	MND	MND	MND	MND	MND	MND	MND
	Replacement	B4	MND	MND	MND	MND	MND	MND	MND
	Refurbishment	B5	MND	MND	MND	MND	MND	MND	MND
	Operational energy use	B6	MND	MND	MND	MND	MND	MND	MND
	Operational water use	B7	MND	MND	MND	MND	MND	MND	MND
%92 Recycling / %8 Landfill Scenario									
End of life	Deconstruction, demolition	C1	0	0	0	0	0	0	0
	Transport	C2	40.6	40.3	-0.046	0.312	5.10E-15	0.178	1.14E-04
	Waste processing	C3	0	0	0	0	0	0	0
	Disposal	C4	1.18	1.21	-0.035	0.004	4.70E-15	0.009	2.03E-06
Potential benefits and loads beyond the system boundaries	Reuse, recovery, recycling potential	D	-1.61E+03	-1.61E+03	2.81	-0.038	7.54E-12	-4.45	-2.78E-04
100% Lanfill Scenario									
End of life	Deconstruction, demolition	C1	0	0	0	0	0	0	0
	Transport	C2	1.88	1.86	-0.002	0.015	2.38E-16	0.007	5.53E-06
	Waste processing	C3	0	0	0	0	0	0	0
	Disposal	C4	14.7	15.1	-0.439	0.044	5.87E-14	0.108	2.54E-05
Potential benefits and loads beyond the system boundaries	Reuse, recovery, recycling potential	D	1.85E+02	1.85E+02	-0.323	0.004	-8.65E-13	0.511	3.20E-05
100% Recycling Scenario									
End of life	Deconstruction, demolition	C1	0	0	0	0	0	0	0
	Transport	C2	43.9	43.6	-0.049	0.338	5.53E-15	0.192	1.23E-04
	Waste processing	C3	0	0	0	0	0	0	0
	Disposal	C4	0	0	0	0	0	0	0
Potential benefits and loads beyond the system boundaries	Reuse, recovery, recycling potential	D	-1.76E+03	-1.77E+03	3.08	-0.042	8.27E-12	-4.88	-3.05E-04

GWP-total = Global warming potential, total;
GWP-fossil = Global warming potential, fossil;
GWP-biogenic = Global warming potential, biogenic;
GWP-luluc = Global warming potential, land use and land use change;

ODP = Depletion potential of the stratospheric ozone layer;
AP = Acidification potential, accumulated exceedance; and
EP-freshwater = Eutrophication potential, fraction of nutrients reaching freshwater end compartment

LCA Results (continued)

(MND = module not declared; MNR = module not relevant; INA = indicator not assessed; AGG = aggregated)

Parameters describing environmental impacts									
			EP-marine	EP-terrestrial	POCP	ADP-mineral &metals	ADP-fossil	WDP	PM
			kg N eq	mol N eq	kg NMVOC eq	kg Sb eq	MJ, net calorific value	m^3 world eq deprived	disease incidence
Product stage	Raw material supply	A1	0.749	11.7	3.09	3.19E-04	1.93E+04	66.6	4.70E-05
	Transport	A2	0.749	8.20	2.10	2.44E-06	954	0.133	4.90E-05
	Manufacturing	A3	0.551	6.02	1.79	6.14E-05	8.66E+03	295	5.67E-05
	Total (of product stage)	A1-3	2.05	25.9	6.98	3.83E-04	2.89E+04	3.62E+02	1.53E-04
Construction process stage	Transport	A4	MND	MND	MND	MND	MND	MND	MND
	Construction	A5	MND	MND	MND	MND	MND	MND	MND
Use stage	Use	B1	MND	MND	MND	MND	MND	MND	MND
	Maintenance	B2	MND	MND	MND	MND	MND	MND	MND
	Repair	B3	MND	MND	MND	MND	MND	MND	MND
	Replacement	B4	MND	MND	MND	MND	MND	MND	MND
	Refurbishment	B5	MND	MND	MND	MND	MND	MND	MND
	Operational energy use	B6	MND	MND	MND	MND	MND	MND	MND
	Operational water use	B7	MND	MND	MND	MND	MND	MND	MND
%92 Recycling / %8 Landfill Scenario									
End of life	Deconstruction, demolition	C1	0	0	0	0	0	0	0
	Transport	C2	0.085	0.940	0.179	2.97E-06	536	0.334	1.39E-06
	Waste processing	C3	0	0	0	0	0	0	0
	Disposal	C4	0.002	0.025	0.007	1.14E-07	16.0	0.130	1.07E-07
Potential benefits and loads beyond the system boundaries	Reuse, recovery, recycling potential	D	-0.924	-10.0	-3.09	3.45E-05	-1.17E+04	33.1	-5.81E-05
100% Lanfill Scenario									
End of life	Deconstruction, demolition	C1	0	0	0	0	0	0	0
	Transport	C2	0.003	0.035	0.006	1.42E-07	24.8	0.016	3.43E-08
	Waste processing	C3	0	0	0	0	0	0	0
	Disposal	C4	0.028	0.307	0.085	1.43E-06	201	1.62	1.34E-06
Potential benefits and loads beyond the system boundaries	Reuse, recovery, recycling potential	D	0.106	1.15	0.355	-3.96E-06	1.35E+03	-3.8	6.68E-06
100% Recycling Scenario									
End of life	Deconstruction, demolition	C1	0	0	0	0	0	0	0
	Transport	C2	0.092	1.02	0.194	3.22E-06	581	0.362	1.50E-06
	Waste processing	C3	0	0	0	0	0	0	0
	Disposal	C4	0	0	0	0	0	0	0
Potential benefits and loads beyond the system boundaries	Reuse, recovery, recycling potential	D	-1.010	-11.0	-3.39	3.78E-05	-1.29E+04	36.3	-6.38E-05

EP-marine = Eutrophication potential, fraction of nutrients reaching marine end compartment;
EP-terrestrial = Eutrophication potential, accumulated exceedance;
POCP = Formation potential of tropospheric ozone;
ADP-mineral&metals = Abiotic depletion potential for non-fossil resources;
ADP-fossil = Depletion potential of the stratospheric ozone layer;
WDP = Water (user) deprivation potential, deprivation-weighted water consumption; and
PM = Particulate matter.

LCA Results (continued)

(MND = module not declared; MNR = module not relevant; INA = indicator not assessed; AGG = aggregated)

Parameters describing environmental impacts							
			IRP	ETP-fw	HTP-c	HTP-nc	SQP
			kBq U^{235} eq	CTUe	CTUh	CTUh	dimensionless
Product stage	Raw material supply	A1	25.6	1.11E-03	2.33E-07	6.27E-06	9.54E+02
	Transport	A2	0.152	2.26E-05	1.29E-08	6.05E-07	10.7
	Manufacturing	A3	1.24	3.29E-04	4.18E-07	1.03E-04	442
	Total (of product stage)	A1-3	27.0	1.46E-03	6.64E-07	1.10E-04	1.41E+03
Construction process stage	Transport	A4	MND	MND	MND	MND	MND
	Construction	A5	MND	MND	MND	MND	MND
Use stage	Use	B1	MND	MND	MND	MND	MND
	Maintenance	B2	MND	MND	MND	MND	MND
	Repair	B3	MND	MND	MND	MND	MND
	Replacement	B4	MND	MND	MND	MND	MND
	Refurbishment	B5	MND	MND	MND	MND	MND
	Operational energy use	B6	MND	MND	MND	MND	MND
	Operational water use	B7	MND	MND	MND	MND	MND
%92 Recycling / %8 Landfill Scenario							
End of life	Deconstruction, demolition	C1	0	0	0	0	
	Transport	C2	0.092	1.14E-04	7.79E-09	4.56E-07	174
	Waste processing	C3	0	0	0	0	0
	Disposal	C4	0.018	2.03E-06	1.35E-09	1.49E-07	3.24
Potential benefits and loads beyond the system boundaries	Reuse, recovery, recycling potential	D	18.4	-2.78E-04	-2.56E-06	-8.72E-06	961
100% Lanfill Scenario							
End of life	Deconstruction, demolition	C1	0	0	0	0	0
	Transport	C2	0.004	5.53E-06	3.61E-10	2.14E-08	8.51
	Waste processing	C3	0	0	0	0	0
	Disposal	C4	0.221	2.54E-05	1.69E-08	1.86E-06	40.5
Potential benefits and loads beyond the system boundaries	Reuse, recovery, recycling potential	D	-2.12	3.20E-05	2.94E-07	1.00E-06	-110
100% Recycling Scenario							
End of life	Deconstruction, demolition	C1	0	0	0	0	0
	Transport	C2	0.100	1.23E-04	8.44E-09	4.94E-07	189
	Waste processing	C3	0	0	0	0	0
	Disposal	C4	0	0	0	0	0
Potential benefits and loads beyond the system boundaries	Reuse, recovery, recycling potential	D	20.2	-3.05E-04	-2.80E-06	-9.56E-06	1050

IRP = Potential human exposure efficiency relative to U235;
ETP-fw = Potential comparative toxic unit for ecosystems;
HTP-c = Potential comparative toxic unit for humans;
HTP-nc = Potential comparative toxic unit for humans; and
SQP = Potential soil quality index.

LCA Results (continued)

(MND = module not declared; MNR = module not relevant; INA = indicator not assessed; AGG = aggregated)

Parameters describing resource use, primary energy								
			PERE	PERM	PERT	PENRE	PENRM	PENRT
			MJ	MJ	MJ	MJ	MJ	MJ
Product stage	Raw material supply	A1	780	0	780	1.93E+04	0	1.93E+04
	Transport	A2	4.53	0	4.53	956	0	956
	Manufacturing	A3	2.05E+03	0	2.05E+03	8.66E+03	0	8.66E+03
	Total (of product stage)	A1-3	2.83E+03	0	2.83E+03	2.89E+04	0	2.89E+04
Construction process stage	Transport	A4	MND	MND	MND	MND	MND	MND
	Construction	A5	MND	MND	MND	MND	MND	MND
Use stage	Use	B1	MND	MND	MND	MND	MND	MND
	Maintenance	B2	MND	MND	MND	MND	MND	MND
	Repair	B3	MND	MND	MND	MND	MND	MND
	Replacement	B4	MND	MND	MND	MND	MND	MND
	Refurbishment	B5	MND	MND	MND	MND	MND	MND
	Operational energy use	B6	MND	MND	MND	MND	MND	MND
	Operational water use	B7	MND	MND	MND	MND	MND	MND
%92 Recycling / %8 Landfill Scenario								
End of life	Deconstruction, demolition	C1	0	0	0	0	0	0
	Transport	C2	28.4	0	28.4	537	0	537
	Waste processing	C3	0	0	0	0	0	0
	Disposal	C4	2.16	0	2.16	16.1	0	16.1
Potential benefits and loads beyond the system boundaries	Reuse, recovery, recycling potential	D	1.50E+03	0	1.50E+03	-1.19E+04	0	-1.19E+04
100% Landfill Scenario								
End of life	Deconstruction, demolition	C1	0	0	0	0	0	0
	Transport	C2	1.38	0	1.38	24.8	0	24.8
	Waste processing	C3	0	0	0	0	0	0
	Disposal	C4	27.0	0	27.0	201	0	201
Potential benefits and loads beyond the system boundaries	Reuse, recovery, recycling potential	D	-172	0	-172	1.36E+03	0	1.36E+03
100% Recycling Scenario								
End of life	Deconstruction, demolition	C1	0	0	0	0	0	0
	Transport	C2	30.7	0	30.7	582	0	582
	Waste processing	C3	0	0	0	0	0	0
	Disposal	C4	0	0	0	0	0	0
Potential benefits and loads beyond the system boundaries	Reuse, recovery, recycling potential	D	1.64E+03	0	1.64E+03	-1.30E+04	0	-1.30E+04

PERE = Use of renewable primary energy excluding renewable primary energy used as raw materials;
PERM = Use of renewable primary energy resources used as raw materials;
PERT = Total use of renewable primary energy resources;
PENRE = Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials;
PENRM = Use of non-renewable primary energy resources used as raw materials;
PENRT = Total use of non-renewable primary energy resource

LCA Results (continued)

(MND = module not declared; MNR = module not relevant; INA = indicator not assessed; AGG = aggregated)

Parameters describing resource use, secondary materials and fuels, use of water						
			SM	RSF	NRSF	FW
			kg	MJ net calorific value	MJ net calorific value	m^3
Product stage	Raw material supply	A1	0	0	0	66.6
	Transport	A2	0	0	0	0.133
	Manufacturing	A3	-94.8	0	0	295
	Total (of product stage)	A1-3	-94.8	0	0	3.62E+02
Construction process stage	Transport	A4	MND	MND	MND	MND
	Construction	A5	MND	MND	MND	MND
Use stage	Use	B1	MND	MND	MND	MND
	Maintenance	B2	MND	MND	MND	MND
	Repair	B3	MND	MND	MND	MND
	Replacement	B4	MND	MND	MND	MND
	Refurbishment	B5	MND	MND	MND	MND
	Operational energy use	B6	MND	MND	MND	MND
	Operational water use	B7	MND	MND	MND	MND
%92 Recycling / %8 Landfill Scenario						
End of life	Deconstruction, demolition	C1	0	0	0	0
	Transport	C2	0	0	0	0.334
	Waste processing	C3	0	0	0	0
	Disposal	C4	0	0	0	0.130
Potential benefits and loads beyond the system boundaries	Reuse, recovery, recycling potential	D	-825	0	0	33.1
100% Landfill Scenario						
End of life	Deconstruction, demolition	C1	0	0	0	0
	Transport	C2	0	0	0	0.016
	Waste processing	C3	0	0	0	0
	Disposal	C4	0	0	0	1.62
Potential benefits and loads beyond the system boundaries	Reuse, recovery, recycling potential	D	94.8	0	0	-3.80
100% Recycling Scenario						
End of life	Deconstruction, demolition	C1	0	0	0	0
	Transport	C2	0	0	0	0.362
	Waste processing	C3	0	0	0	0
	Disposal	C4	0	0	0	0
Potential benefits and loads beyond the system boundaries	Reuse, recovery, recycling potential	D	-905	0	0	36.3

SM = Use of secondary material;
RSF = Use of renewable secondary fuels;
NRSF = Use of non-renewable secondary fuels;
FW = Net use of fresh water

LCA Results (continued)

(MND = module not declared; MNR = module not relevant; INA = indicator not assessed; AGG = aggregated)

Other environmental information describing waste categories					
			HWD	NHWD	RWD
			kg	kg	kg
Product stage	Raw material supply	A1	1.81E-06	8.13	0.175
	Transport	A2	8.43E-09	0.097	1.06E-03
	Manufacturing	A3	1.03E-06	44	0.017
	Total (of product stage)	A1-3	2.85E-06	5.22E+01	0.193
Construction process stage	Transport	A4	MND	MND	MND
	Construction	A5	MND	MND	MND
Use stage	Use	B1	MND	MND	MND
	Maintenance	B2	MND	MND	MND
	Repair	B3	MND	MND	MND
	Replacement	B4	MND	MND	MND
	Refurbishment	B5	MND	MND	MND
	Operational energy use	B6	MND	MND	MND
	Operational water use	B7	MND	MND	MND
%92 Recycling / %8 Landfill Scenario					
End of life	Deconstruction, demolition	C1	0	0	0
	Transport	C2	2.58E-08	0.078	6.46E-04
	Waste processing	C3	0	0	0
	Disposal	C4	1.70E-09	80.1	1.68E-04
Potential benefits and loads beyond the system boundaries	Reuse, recovery, recycling potential	D	1.44E-06	-23.3	0.193
100% Landfill Scenario					
End of life	Deconstruction, demolition	C1	0	0.000	0.00E+00
	Transport	C2	1.25E-09	0.004	3.00E-05
	Waste processing	C3	0	0	0
	Disposal	C4	2.13E-08	1.00E+03	0.002
Potential benefits and loads beyond the system boundaries	Reuse, recovery, recycling potential	D	-1.65E-07	2.68	-0.022
100% Recycling Scenario					
End of life	Deconstruction, demolition	C1	0	0	0
	Transport	C2	2.79E-08	0.085	6.99E-04
	Waste processing	C3	0	0	0
	Disposal	C4	0	0	0
Potential benefits and loads beyond the system boundaries	Reuse, recovery, recycling potential	D	1.58E-06	-25.6	0.212

HWD = Hazardous waste disposed;
NHWD = Non-hazardous waste disposed;
RWD = Radioactive waste disposed

LCA Results (continued)

(MND = module not declared; MNR = module not relevant; INA = indicator not assessed; AGG = aggregated)

Other environmental information describing output flows – at end of life								
			CRU	MFR	MER	EE	Biogenic carbon (product)	Biogenic carbon (packaging)
			kg	kg	kg	MJ per energy carrier	kg C	kg C
Product stage	Raw material supply	A1	0	0	0	0	0	0
	Transport	A2	0	0	0	0	0	0
	Manufacturing	A3	0	0	0	0	0	0
	Total (of product stage)	A1-3	0	0	0	0	0	0
Construction process stage	Transport	A4	MND	MND	MND	MND	MND	MND
	Construction	A5	MND	MND	MND	MND	MND	MND
Use stage	Use	B1	MND	MND	MND	MND	MND	MND
	Maintenance	B2	MND	MND	MND	MND	MND	MND
	Repair	B3	MND	MND	MND	MND	MND	MND
	Replacement	B4	MND	MND	MND	MND	MND	MND
	Refurbishment	B5	MND	MND	MND	MND	MND	MND
	Operational energy use	B6	MND	MND	MND	MND	MND	MND
	Operational water use	B7	MND	MND	MND	MND	MND	MND
%92 Recycling / %8 Landfill Scenario								
End of life	Deconstruction, demolition	C1	0	-920	0	0	0	0
	Transport	C2	0	0	0	0	0	0
	Waste processing	C3	0	0	0	0	0	0
	Disposal	C4	0	0	0	0	0	0
Potential benefits and loads beyond the system boundaries	Reuse, recovery, recycling potential	D	0	0	0	0	0	0
100% Landfill Scenario								
End of life	Deconstruction, demolition	C1	0	0	0	0	0	0
	Transport	C2	0	0	0	0	0	0
	Waste processing	C3	0	0	0	0	0	0
	Disposal	C4	0	0	0	0	0	0
Potential benefits and loads beyond the system boundaries	Reuse, recovery, recycling potential	D	0	0	0	0	0	0
100% Recycling Scenario								
End of life	Deconstruction, demolition	C1	0	-1.00E+03	0	0	0	0
	Transport	C2	0	0	0	0	0	0
	Waste processing	C3	0	0	0	0	0	0
	Disposal	C4	0	0	0	0	0	0
Potential benefits and loads beyond the system boundaries	Reuse, recovery, recycling potential	D	0	0	0	0	0	0

CRU = Components for reuse;
MFR = Materials for recycling

MER = Materials for energy recovery;
EE = Exported Energy

Scenarios and additional technical information

Scenarios and additional technical information			
Scenario	Parameter	Units	Results
C1 to C4 End of life,	The end-of-life stage starts when the construction product is replaced, dismantled or deconstructed from the building or construction works and does not provide any further function. The recovered steel is transported for recycling while a small portion is assumed to be unrecoverable and remains in the rubble which is sent to landfill. 92% of the structural steel is assumed to be recycled and 8% is sent to landfill [STEELCONSTRUCTION.INFO 2012]. Once steel scrap is generated through the deconstruction activities on the demolition site it is considered to have reached the “end of waste” state. No further processing is required so there are no impacts associated with this module. Hence no impacts are reported in module C3.		
	Waste for recycling - Recovered steel from crushed concrete	%	92
	Waste for energy recovery - Energy recovery is not considered for this study as most end of life steel scrap is recycled, while the remainder is landfilled	-	-
	Waste for final disposal - Unrecoverable steel lost in crushed concrete and sent to landfill	%	8
	Portion of energy assigned to rebar from energy required to demolish building, per tonne	MJ	24
	Transport to waste processing by Truck - Fuel consumption	litre/km	1.56
	Transport to waste processing by Truck – Distance	km	463
	Transport to waste processing by Truck – Capacity utilisation	%	85
	Transport to waste processing by Truck – Density of Product	kg/m^3	7850
	Transport to waste processing by Container ship - Fuel consumption	litre/km	0.0041
	Transport to waste processing by Container ship - Distance	km	158
	Transport to waste processing by Container ship – Capacity utilisation	%	50
	Transport to waste processing by Container ship – Density of Product	kg/m^3	7850
Module D	It is assumed that 92% of the steel used in the structure is recovered for recycling, while the remainder is landfilled. “Benefits and loads beyond the system boundary” (module D) accounts for the environmental benefits and loads resulting from net steel scrap that is used as raw material in the EAF and that is collected for recycling at end of life. The balance between total scrap arisings recycled from fabrication, installation and end of life and scrap consumed by the manufacturing process (internally sourced scrap is not included in this calculation). These benefits and loads are calculated by including the burdens of recycling and the benefit of avoided primary production. A large amount of net scrap is generated over the life cycle as the Direct Reduced Iron (DRI) production route is primarily from virgin sources and there is a very high end of life recycling rate for reinforcing steel products. As a result, module D reports the credits associated with the scrap output. The resulting scrap credit/burden is calculated based on the global “value of scrap” approach (/worldsteel 2011).		
	Recycled Content	kg	98
	Re-used Content	kg	0
	Recovered for recycling	kg	920
	Recovered for re-use	kg	0
	Recovered for energy	kg	0

Summary, comments and additional information

Interpretation

Direct Reduced Iron based hot rolled flat steel product of Saudi Iron and Steel Company (HADEED) is made via the EAF route. The bulk of the environmental impacts and primary energy demand is attributed to the manufacturing phase, covered by information modules A1-A3 of EN 15804+A2.

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