Statement of Verification

BREG EN EPD No.: 000373 Issue 01

This is to verify that the

Environmental Product Declaration

provided by:

Al Ittefaq Steel Products Company
(member of UK CARES)

is in accordance with the requirements of:

EN 15804:2012+A1:2013

and

BRE Global Scheme Document SD207

This declaration is for:

Carbon Steel Reinforcing Bar (secondary production route – scrap)

Company Address

PO Box 7600
Dammam
31742
Saudi Arabia

حـديـد الإتـفـاق
AL-ITTEFAQ STEEL

Signed for BRE Global Ltd	Emma Baker Operator	25 November 2021 Date of this Issue
25 November 2021 Date of First Issue		24 November 2024 Expiry Date

BRE Global Verified EPD

ECO PLATFORM EPD EN 15804 VERIFIED

Environmental Product Declaration

EPD Number: 000373

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 15804:2012+A1:2013
Commissioner of LCA study	**LCA consultant/Tool**
UK CARES Pembroke House 21 Pembroke Road Sevenoaks Kent, TN13 1XR UK	UK CARES EPD Tool Thinkstep Ltd. (Sphera) 1st Floor 1 East Poultry Avenue London ECA1A 9PT www.sphera.com
Declared/Functional Unit	**Applicability/Coverage**
1 tonne of carbon steel reinforcing bars manufactured by the secondary (scrap-based) production route as used within concrete structures for a commercial building.	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+A1:2013. 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+A1:2013 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(s)

Al Ittefaq Steel Products Company (member of UK CARES)

PO Box 7600
Dammam
31742
Saudi Arabia

Construction Product:

Product Description

Reinforcing steel bar (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.

The declared unit is 1 tonne of carbon steel reinforcing bars as used within concrete structures for a commercial building.

Technical Information

Property	Value, Unit
Production route	EAF
Density	7850 kg/m^3
Modulus of elasticity	200000 N/mm^2
Weldability (Ceq)	max 0.50 %
Yield strength (as per BS 4449:2005)	min 500 N/mm^2
Tensile strength (as per BS 4449:2005)	min 540 N/mm^2 (Tensile strength/Yield Strength ≥ 1.08)
Surface geometry (Relative rib area, f_R as per BS 4449:2005)	0.040 for Bar Size >6mm & ≤12mm 0.056 for Bar Size>12
Agt (% total elongation at maximum force as per BS 4449:2005)	min 5 %
Re-bend test (as per BS 4449:2005)	Pass
Fatigue test (as per BS 4449:2005)	Pass
Recycled content (as per ISO 14021:2016, based on weighted average from suppliers)	39.2 %

Main Product Contents

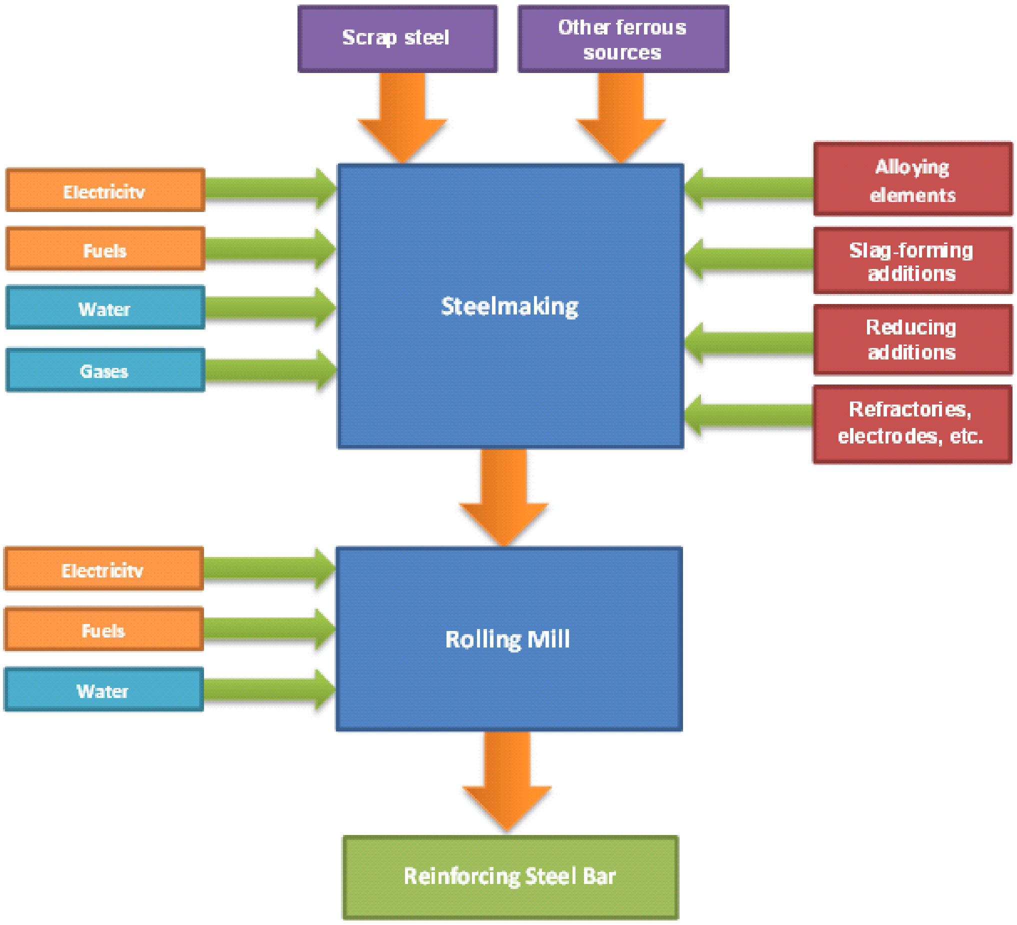
Material/Chemical Input	%
Fe	97
C, Mn, Si, V, Ni, Cu, Cr, Mo and others	3

Manufacturing Process

Scrap metal is melted in an electric arc furnace to obtain liquid steel. This is then refined to remove impurities and alloying additions can be added to give the required properties.

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 bars and coils of reinforcing steel.

Process flow diagram



Construction Installation

Processing and proper use of reinforcing 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 reinforcing steel products the usual requirements for securing loads is to be observed.

Use Information

The composition of the reinforcing steel products does not change during use.

Reinforcing 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 bar product itself.

End of Life

Reinforcing steel products are not reused at end of life but 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 bar products.

Life Cycle Assessment Calculation Rules

Declared / Functional unit description

The declared unit is 1 tonne of carbon steel reinforcing bars manufactured by the secondary (scrap-based) production route as used within concrete structures for a commercial building (i.e. 1 tonne in use, accounting for losses during fabrication and installation, not 1 tonne as produced).

System boundary

The system boundary of the EPD follows the modular design defined by EN 15804. This is a cradle to gate – with all options EPD and thus covers all modules from A1 to C4 and includes module D as well.

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.

Data sources, quality and allocation

Data Sources: Manufacturing data of the period 01/01/2020-31/12/2020 has been provided by Al Ittefaq Steel Products Company (member of UK CARES).

Data Quality: Data quality can be described as good. Background data are consistently sourced from the GaBi 2020 databases (Sphera 2020). The primary data collection was thorough, considering all relevant flows and these data have been verified by UK CARES.

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

Geographical Representativeness	Technical Representativeness	Time Representativeness
Good	Very Good	Good

Allocation: 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.

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 2019/).

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.

LCA Results

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

Parameters describing environmental impacts			GWP	ODP	AP	EP	POCP	ADPE	ADPF
			kg CO_2 equiv.	kg CFC 11 equiv.	kg SO_2 equiv.	kg $(PO_4)^{3-}$ equiv.	kg C_2H_4 equiv.	kg Sb equiv.	MJ, net calorific value.
Product stage	Raw material supply	A1	AGG	AGG	AGG	AGG	AGG	AGG	AGG
	Transport	A2	AGG	AGG	AGG	AGG	AGG	AGG	AGG
	Manufacturing	A3	AGG	AGG	AGG	AGG	AGG	AGG	AGG
	Total (of product stage)	A1-3	977	8.79E-07	7.95	0.456	0.461	1.49E-04	1.17E+04
Construction process stage	Transport	A4	16.4	2.85E-15	0.034	0.008	-0.012	1.43E-06	222
	Construction	A5	108	8.76E-08	0.899	0.052	0.045	1.63E-05	1.32E+03
Use stage	Use	B1	0	0	0	0	0	0	0
	Maintenance	B2	0	0	0	0	0	0	0
	Repair	B3	0	0	0	0	0	0	0
	Replacement	B4	0	0	0	0	0	0	0
	Refurbishment	B5	0	0	0	0	0	0	0
	Operational energy use	B6	0	0	0	0	0	0	0
	Operational water use	B7	0	0	0	0	0	0	0
End of life	Deconstruction, demolition	C1	2.11	3.31E-16	0.003	4.07E-04	3.06E-04	7.31E-08	28.2
	Transport	C2	39.5	6.81E-15	0.122	0.031	-0.034	3.32E-06	535
	Waste processing	C3	0	0	0	0	0	0	0
	Disposal	C4	1.15	6.26E-15	0.007	7.85E-04	5.26E-04	4.22E-07	15.6
Potential benefits and loads beyond the system boundaries	Reuse, recovery, recycling potential	D	529	-3.36E-12	1.22	0.104	0.159	-3.15E-05	4.14E+03

GWP = Global Warming Potential;
ODP = Ozone Depletion Potential;
AP = Acidification Potential for Soil and Water;
EP = Eutrophication Potential;
POCP = Formation potential of tropospheric Ozone;
ADPE = Abiotic Depletion Potential – Elements;
ADPF = Abiotic Depletion Potential – Fossil Fuels;

LCA Results (continued)

Parameters describing resource use, primary energy			PERE	PERM	PERT	PENRE	PENRM	PENRT
			MJ	MJ	MJ	MJ	MJ	MJ
Product stage	Raw material supply	A1	AGG	AGG	AGG	AGG	AGG	AGG
	Transport	A2	AGG	AGG	AGG	AGG	AGG	AGG
	Manufacturing	A3	AGG	AGG	AGG	AGG	AGG	AGG
	Total (of product stage)	A1-3	1.25E+03	0	1.25E+03	1.28E+04	0	1.28E+04
Construction process stage	Transport	A4	12.4	0	12.4	223	0	223
	Construction	A5	168	0	168	1.42E+03	0	1.42E+03
Use stage	Use	B1	0	0	0	0	0	0
	Maintenance	B2	0	0	0	0	0	0
	Repair	B3	0	0	0	0	0	0
	Replacement	B4	0	0	0	0	0	0
	Refurbishment	B5	0	0	0	0	0	0
	Operational energy use	B6	0	0	0	0	0	0
	Operational water use	B7	0	0	0	0	0	0
End of life	Deconstruction, demolition	C1	0.098	0	0.098	28.3	0	28.3
	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	-501	0	-501	3.97E+03	0	3.97E+03

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)

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	AGG	AGG	AGG	AGG
	Transport	A2	AGG	AGG	AGG	AGG
	Manufacturing	A3	AGG	AGG	AGG	AGG
	Total (of product stage)	A1-3	1.19E+03	-0.207	-2.50	1.09
Construction process stage	Transport	A4	0	0	0	0.014
	Construction	A5	118	-0.021	-0.249	0.212
Use stage	Use	B1	0	0	0	0
	Maintenance	B2	0	0	0	0
	Repair	B3	0	0	0	0
	Replacement	B4	0	0	0	0
	Refurbishment	B5	0	0	0	0
	Operational energy use	B6	0	0	0	0
	Operational water use	B7	0	0	0	0
End of life	Deconstruction, demolition	C1	0	0	0	1.98E-04
	Transport	C2	0	0	0	0.033
	Waste processing	C3	0	0	0	0
	Disposal	C4	0	0	0	0.004
Potential benefits and loads beyond the system boundaries	Reuse, recovery, recycling potential	D	0	0	0	0.362

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)

Other environmental information describing waste categories					
			HWD	NHWD	RWD
			kg	kg	kg
Product stage	Raw material supply	A1	AGG	AGG	AGG
	Transport	A2	AGG	AGG	AGG
	Manufacturing	A3	AGG	AGG	AGG
	Total (of product stage)	A1-3	0.800	107	0.417
Construction process stage	Transport	A4	1.12E-08	0.033	2.70E-04
	Construction	A5	0.080	20.5	0.042
Use stage	Use	B1	0	0	0
	Maintenance	B2	0	0	0
	Repair	B3	0	0	0
	Replacement	B4	0	0	0
	Refurbishment	B5	0	0	0
	Operational energy use	B6	0	0	0
	Operational water use	B7	0	0	0
End of life	Deconstruction, demolition	C1	2.42E-10	0.006	3.10E-05
	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	-4.82E-07	7.79	-0.065

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

LCA Results (continued)

Other environmental information describing output flows – at end of life			CRU	MFR	MER	EE
			kg	kg	kg	MJ per energy carrier
Product stage	Raw material supply	A1	AGG	AGG	AGG	AGG
	Transport	A2	AGG	AGG	AGG	AGG
	Manufacturing	A3	AGG	AGG	AGG	AGG
	Total (of product stage)	A1-3	0	0	0	0
Construction process stage	Transport	A4	0	0	0	0
	Construction	A5	0	120	0	0
Use stage	Use	B1	0	0	0	0
	Maintenance	B2	0	0	0	0
	Repair	B3	0	0	0	0
	Replacement	B4	0	0	0	0
	Refurbishment	B5	0	0	0	0
	Operational energy use	B6	0	0	0	0
	Operational water use	B7	0	0	0	0
End of life	Deconstruction, demolition	C1	0	0	0	0
	Transport	C2	0	0	0	0
	Waste processing	C3	0	920	0	0
	Disposal	C4	0	0	0	0
Potential benefits and loads beyond the system boundaries	Reuse, recovery, recycling potential	D	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
A4 – Transport to the building site	On leaving the steelworks the reinforcing steel bars are transported to a fabricator where they are converted into constructional steel forms suitable for the installation site, then transported on to the construction site; including provision of all materials and products. Road transport distance for rolled steel to fabricators and road transport distance for steel construction forms to site are assumed to be 100 km and 250 km, respectively. Only the one-way distance is considered as it is assumed that the logistics companies will optimise their distribution and not return empty in modules beyond A3.		
	Truck trailer - Fuel	L/km	1.56
	Distance	km	350
	Capacity utilisation	%	85
	Bulk density of transported products	kg/m^3	7850
A5 – Installation in the building	The fabrication process is a relatively simple unit process and accounts for the transformation of the rolled steel product into construction steel forms. The operations in this unit process are primarily cutting, welding and bending. As such, other inputs to the process include electricity, thermal energy, and cutting gases. Other outputs of this process are steel scrap and wastewater (where applicable). Fabrication into reinforcing steel products and installation in the building; including provision of all materials, products and energy, as well as waste processing up to the end-of-waste state or disposal of final residues during the construction stage. Installation of the fabricated product into the building is assumed to result in 10% wastage (determined based on typical installation losses reported by the WRAP Net Waste Tool [WRAP 2017]). It is assumed that fabrication requires 15.34 kWh/tonne finished product, and that there is a 2% wastage associated with this process.		
	Ancillary materials for installation - Waste material from fabrication, losses per tonne of construction steel forms	%	2
	Energy Use - Energy per tonne required to fabricate construction steel forms	kWh	15.34
	Waste materials from installation wastage	%	10
B2 – Maintenance	No maintenance required		
B3 – Repair	No repair process required		
B4 – Replacement	No replacement considerations required		
B5 – Refurbishment	No refurbishment process required		
Reference service life	Reinforcing steel products are used in the main building structure so the reference service life will equal the lifetime of the building. The Concrete Society follows the definitions provided in BS EN 1990, which specifies “building structures and other common structures” as having a lifetime of 50 years (The Concrete Society, n.d.; BSI, 2005). On this basis, the RSL for this EPD is assumed to be 50 years.		
	Reference service life	Years	50
B6 – Use of energy; B7 – Use of water	No water or energy required during use stage related to the operation of the building		

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 steel reinforcing bar is assumed to be recycled and 8% is sent to landfill (Sanson, 2014). 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	L/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/m³	7850
	Transport to waste processing by Container ship - Fuel consumption	L/km	0.00401
	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/m³	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. The resulting scrap credit/burden is calculated based on the global "value of scrap" approach (/worldsteel 2011).		

Summary, comments and additional information

Scrap-based carbon steel rebar of Union Iron & Steel Company L.L.C (member of UK CARES) 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.

The interpretation of the results has been carried out considering the methodology- and data-related assumptions and limitations declared in the EPD. This interpretation section focuses on the environmental impact categories as well as the primary energy demand indicators only.

Global Warming Potential (GWP)

The majority of the life cycle GWP impact occurs in the production phase (A1-A3). A1-A3 impacts account for 85.39% overall life cycle impacts for this category. The most significant contributions to production phase impacts are: the upstream production of raw materials used in the steelmaking process, generation/supply of electricity and the production/use of fuels on site. Fabrication, installation and the end-of-life processes covered in C1-C4 make a minimal contribution to GWP. Scrap burdens reported in module D have a significant contribution.

Ozone Depletion Potential (ODP)

The majority of impacts are associated with the production phase (A1-3). Significant contributions to production phase impact come from the emission of ozone depleting substances during the upstream production of raw materials/pre-products as well as those arising from electricity production. Module D shows a very small credit even though scrap burdens are being assessed in this phase. This is explained because ODP emissions are linked to grid electricity production used in secondary production.

Acidification Potential (AP)

The majority of the lifecycle AP impact occurs in the production phase (A1-A3), similar to GWP. The major contributors to production phase AP impacts comes from energy resources used in the production of the raw materials and pre-products for the steelmaking process and from transportation. Fabrication, installation and the end-of-life processes classed under C1-C4 make minimal contributions. As with GWP, scrap burdens reported in module D have a significant contribution.

Eutrophication Potential (EP)

The major eutrophication impacts occur in the production phase (A1-A3). Significant contributions to production phase impact comes from the production of raw materials and transport. Fabrication, installation and the end-of-life processes classed under C1-C4 again make minimal contributions. As with GWP, scrap burdens reported in module D have a significant contribution.

Photochemical Ozone Creation Potential (POCP)

The production phase is the dominant phase of the lifecycle with regards to POCP impacts. Again, these are all emissions commonly associated with the combustion of fuels. Significant contributors to POCP are the upstream production of raw materials/pre-products and transport, directly linked to fossil fuel combustion. It should be noted that the impacts for steel recycling in module D is almost of the same magnitude as the production phase impacts.

Primary Energy Demand - Non-renewable (PENRT)

In terms of lifecycle phases, PENRT exhibits the same trends as other categories driven by the combustion of fossil fuels and other non-renewable fuel sources. A1-A3 is the most significant contributor to life cycle impacts for PENRT. Significant contributions here come from the energy resources used in the production of the raw materials and pre-products for the steelmaking process, from non-renewable resource consumption for electricity generation/supply and the upstream production of fuels used on site. As for GWP, scrap burdens reported in module D have a significant contribution.

Primary Energy Demand – Renewable (PERT)

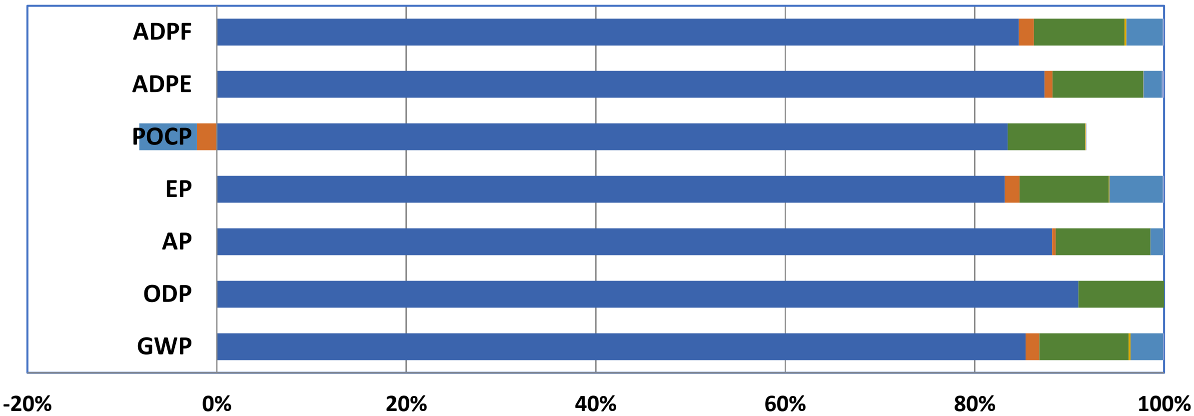
Majority of the energy consumption takes place during the production phase, A1-A3. However, unlike other categories, the largest contributor to PERT impacts here comes from the consumption of renewable energy resources required for the generation/supply of electricity. It should be noted that PERT generally only represents a small percentage of the production phase primary energy demand with the bulk of the demand coming from non-renewable energy resources. The credit observed in module D can be explained by the different energy mixes used for primary and secondary steel production.

Abiotic Depletion Potential (Elements)

The largest contribution to ADP-elements over the entire life cycle is the production phase, A1-A3. The majority of the impacts are from the production of raw materials, in particular the consumption of iron related products.

Abiotic Depletion Potential (Fossil)

The largest contribution to ADP-fossils over the entire life cycle is the production phase, A1-A3. The general trends in this impact category from are very similar to that described in description of PENRT above.



	GWP	ODP	AP	EP	POCP	ADPE	ADPF
A1-3	85.39%	90.94%	88.19%	83.19%	99.84%	87.37%	84.66%
A4	1.43%	0.00%	0.37%	1.54%	-2.51%	0.84%	1.61%
A5	9.44%	9.06%	9.97%	9.43%	9.77%	9.56%	9.55%
C1	0.18%	0.00%	0.03%	0.07%	0.07%	0.04%	0.20%
C2	3.45%	0.00%	1.35%	5.62%	-7.28%	1.95%	3.87%
C3	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
C4	0.10%	0.00%	0.08%	0.14%	0.11%	0.25%	0.11%

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CARES SRC Steel for the Reinforcement of Concrete Scheme. Appendix 1 – Quality and operations assessment schedule for carbon steel bars for the reinforcement of concrete including inspection and testing requirements - http://www.ukcares.com/approved-companies - Certificate number of conformance to BS4449 at the time of LCA study – 040603

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