



# Environmental Product Declaration

## Statement of Verification

CARES EPD No.: 0053

Issue 00

This is to verify that the **Environmental Product Declaration**

Provided by:  
Arabian Gulf Steel Industries LLC

Is in accordance with the requirements of:  
ISO 14025:2010 and EN 15804:2012 + A2:2019/AC2021  
and CARES PCR for Type III EPD of Semi-Finished and Finished Steel Products, February 2025

This declaration is for:  
Carbon Steel Reinforcing Bar (Secondary production route - Scrap)



## Company address:

Arabian Gulf Steel Industries LLC  
(HFZ Branch), HE-08 & HJ-03, 04,  
05, 06A2, Hamriyah Freezone  
P.O Box 7307  
Sharjah-UAE



*LadinCamci*

Ladin Camci

11 March 2026

Signed for CARES

Operator

Date of this Issue

11 March 2026

10 March 2029

First Issue Date

Expiry Date

The validity of this Environmental Product Declaration can be verified by contacting CARES on +44 (0)1732 450 000 or visiting CARES website <https://www.carescertification.com/certification-schemes/environmental-product-declarations>.

CARES, Pembroke House, 21 Pembroke Road, Sevenoaks, Kent TN13 1XR



# Environmental Product Declaration

## Environmental Product Declaration

EPD Number: CARES EPD 0053

### General Information

<b>EPD Programme Operator</b>	CARES Pembroke House, 21 Pembroke Road, Sevenoaks, Kent, TN13 1XR UK <a href="http://www.carescertification.com">www.carescertification.com</a>
<b>Applicable Product Category Rules</b>	CARES Product Category Rules (PCR) for Type III Environmental Product Declaration (EPD) of Semi-Finished and Finished Steel Products, February 2025
<b>Commissioner of LCA study</b>	CARES Pembroke House, 21 Pembroke Road, Sevenoaks, Kent, TN13 1XR UK <a href="http://www.carescertification.com">www.carescertification.com</a>
<b>LCA consultant/Tool</b>	CARES SimaPro10.2 Expert Software system for life cycle assessment, developed by PRé Sustainability (PRé Sustainability B.V., 2024) <a href="https://pre-sustainability.com/">https://pre-sustainability.com/</a>
<b>Declared/Functional Unit</b>	1 tonne of carbon steel reinforcing bars manufactured by the secondary (scrap-based) production route
<b>Applicability/Coverage</b>	Manufacturer-specific product produced at a single plant of one manufacturer
<b>EPD Type</b>	Cradle to Gate with options, Modules C1-C4, and Module D
<b>Background database</b>	ecoinvent 3.11, EN 15804 LCI database

### Demonstration of Verification

CEN standard EN 15804 serves as the core PCR <sup>a</sup>

Independent verification of the declaration and data according to EN ISO 14025:2010

Internal  External

(Where appropriate <sup>b</sup>) Third party verifier:  
Dr Jane Anderson

a: Product category rules

b: Optional for business-to-business communication; mandatory for business-to-consumer communication (see EN ISO 14025:2010, 9.4)



# Environmental Product Declaration

## Comparability

Environmental product declarations from different programmes may not be comparable if not compliant with EN 15804:2012+A2:2019/AC2021. 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/AC2021 for further guidance

## Information modules covered

Product Stage			Construction Stage		Use Stage							End-of-life Stage				Benefits and loads beyond the system boundary
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: Checks indicate the Information Modules declared.

## Manufacturing site

Steel Plant:  
 Arabian Gulf Steel Industries LLC  
 105HR9A, ICAD II, Musaffah  
 P.O. Box 92819  
 Abu Dhabi  
 United Arab Emirates

Rolling Mill:  
 Arabian Gulf Steel Industries LLC (HFZ Branch)  
 HE-08 & HJ-03, 04, 05, 06A2, Hamriyah Freezone  
 P.O. Box 7307  
 Sharjah  
 United Arab Emirates

## Construction Product:

### Product Description

Reinforcing steel bar (according to product standards listed in References) that is obtained from scrap, melted in an Electric Arc Furnace (EAF) followed by hot rolling. These are used to provide tensile strength in reinforced concrete building elements.

This EPD covers carbon steel reinforcing bar products manufactured by Arabian Gulf Steel Industries LLC using the secondary (scrap-based) production route.



# Environmental Product Declaration

## Technical Information

Property	Value, Unit
Production route	Induction Furnace
Density	7850 kg/m <sup>3</sup>
Modulus of elasticity	200000 N/mm <sup>2</sup>
Weldability (C <sub>eq</sub> )	max 0.50 %
Yield strength (as per BS 4449:2005+A3:2016)	min 500 N/mm <sup>2</sup> – max 650 N/mm <sup>2</sup>
Tensile strength (as per BS 4449:2005+A3:2016)	min 540 N/mm <sup>2</sup> (Tensile strength/Yield Strength ≥ 1.08)
Agt (% total elongation at maximum force as per BS 4449:2005+A3:2016)	min 5 %
Surface geometry (Relative rib area, fR as per BS 4449:2005+A3:2016)	min 0.040 for Bar Size >6mm & ≤12mm & min 0.056 for Bar size >12
Re-bend test (as per BS 4449:2005+A3:2016)	Pass
Fatigue test (as per BS 4449:2005+A3:2016)	Pass
Recycled content (as per ISO 14021:2016/Amd:2021)	98.0 (Including internal and external scrap) 97.8 (Including external scrap only)

\* Technical Information details are as per relevant product standards listed in References section.

## Main Product Contents

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

## Manufacturing Process

Arabian Gulf Steel Industries LLC operates a rolling mill that produces reinforcing steel bars by hot rolling steel billets manufactured by its own steel plant, location of both is given in Manufacturing Site section. Billets are sourced via secondary (scrap based) production route using steel scrap in an induction furnace (IF) to obtain liquid steel, then cast the liquid steel into steel billets of specific dimensions using the continuous casting process.

At the rolling mill billets transported from steel plant are reheated and rolled to achieve the specified dimensions, this is followed by controlled cooling, cutting to length, bundling and inspection to relevant product standards. Mill scale generated during rolling is collected and managed as described in the Allocation section.

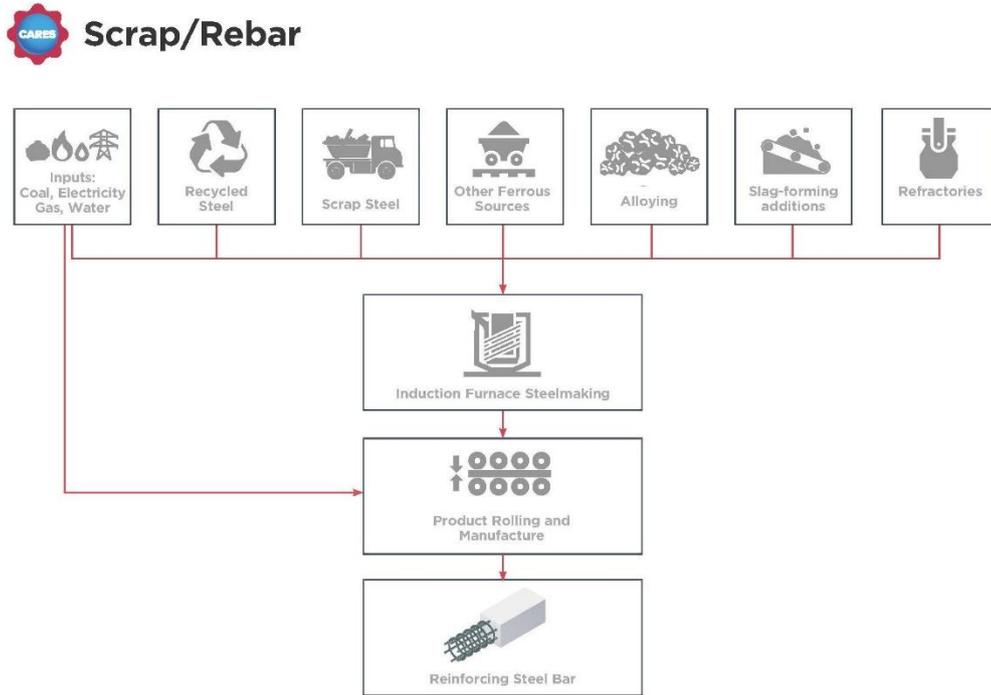
Electricity used in both production units are 100% sourced from nuclear plant during the production period.

The products are packaged by binding with steel wires or straps, both the steel ties and products do not include any biogenic materials



# Environmental Product Declaration

## 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 requirement 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 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 products



## Life Cycle Assessment Calculation Rules

This EPD applies the “cut-off by classification” (recycled content) allocation approach, also known as the recycled content method. Primary production burdens are assigned to the initial user of primary materials; recyclable materials enter the recycling system without upstream burdens, and secondary materials bear only the impacts of recycling/re-melting. The approach follows ISO 14040/14044 and is implemented with ecoinvent v3.11 using the Allocation, cut-off, EN15804 system model

The Life Cycle Impact Assessment (LCIA) has been carried out using the characterisation method described in EN 15804+A2. The characterisation factors from Environmental Footprint v3.1 (EF 3.1) was applied.

## Declared unit description

1 tonne of carbon steel reinforcing bars manufactured via the secondary (scrap-based) production route

## System boundary

The system boundary of the EPD follows the modular design defined by EN 15804+A2. Type of this EPD is Cradle to Gate with options, Modules C1-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.

Steel scrap is considered to reach end-of-waste status when it meets end-of-waste criteria and re-enters the market as a secondary material; recycling/re-melting burdens are included from that point.

## Data sources, quality and allocation

Data Sources:

Data selection and data quality assessment follow BS EN 15941:2024. Manufacturing data has been provided by the carbon steel billet (secondary production route-scrap) and carbon steel reinforcement bar manufacturing facilities of Arabian Gulf Steel Industries LLC (AGSI) operating in the geographical areas specified in the Manufacturing Site section, covering the period 01/01/2023 - 31/12/2023.

As the carbon steel billet manufacturing site is in a separate location, transport of billets from steel plant to rolling mill site has been taken into account in LCA calculations.

A brief description of technology and inputs for the product is given in Manufacturing Process and in simplified Process Flow Diagram.

The primary data collection was thorough, considering all relevant flows and these data were verified by CARES, including also the verification of mass balance, to ensure that data for all the inputs and outputs for the process over the period of data collection have been collected, and that the unit process data will comply with the cut-off rules of EN 15804. The EPD covers transport to, and end-of-life in United Arab Emirates.

Background processes are modelled with ecoinvent v3.11 using the Allocation, cut-off, EN15804 system model.

The selection of the background data for electricity generation is in line with the CARES PCR 2025. Country or region-specific power grid mixes are selected from ecoinvent 3.11, EN 15804 LCI database.

Where contractual instruments are applied, electricity is matched with Clean Energy Certificates (CECs) issued under Abu Dhabi Department of Energy's scheme implemented on the I-REC platform, which can include nuclear attributes. Certificate volume, technology, geography and vintage are documented; the consumption mix is applied to any non-certified consumption.

Electricity accounts for more than 30% of the total energy use in manufacturing; therefore, the GWP of the applied electricity mix for manufacturing (market-based) 0.00419 kg CO<sub>2</sub>e/kWh is selected. 100% of the manufacturing electricity is matched with Abu Dhabi Department of Energy Clean Energy Certificates implemented on the I-REC platform with attributes from nuclear generation. Redemption certificates covering the same reporting year as this EPD (2023) have been obtained and third-party verified. No consumption mix electricity applies to manufacturing under the market-based method.

For the construction stage, use stage, end-of-life stage and Module D, consumption mix is applied for any processes which the EPD owner does not have direct control over, the consumption mix of the United Arab Emirates has been selected from ecoinvent 3.11, EN 15804 LCI database in 0.568 kg CO<sub>2</sub> eq/kWh.



# Environmental Product Declaration

## Data Quality:

Schemes applied for data quality assessment was as per EN 15804:2012+A2:2019, Annex E, Table E.1 — Data quality level and criteria of the UN Environment Global Guidance on LCA database development. No poor or very poor data was found during the assessment of relevant data.

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:

Induction furnace slag and mill scale are produced as co-products from the steel manufacturing processes. Impacts are allocated between the steel, the slag and the mill scale based on economic value. The revenue generated from both mill scale, and induction furnace slag are 0.41% and 0.02% 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 ecoinvent 3.11, EN 15804 LCI database.

## 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 PCR requirements are fulfilled).

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



# Environmental Product Declaration

## LCA Results

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

Core environmental impact indicators									
Life Cycle Stage	Impact Category		GWP-total	GWP-fossil	GWP-biogeni c	GWP-luluc	ODP	AP	EP-freshwater
			kg CO <sub>2</sub> eq	kg CFC11 eq	mol H <sup>+</sup> eq	Kg P eq			
Product stage	Raw material supply	A1	1.15E+02	1.14E+02	0.522	0.052	2.22E-06	0.475	2.67E-03
	Transport	A2	16.8	16.8	0.004	3.60E-04	3.91E-07	0.032	1.21E-05
	Manufacturing	A3	86.1	86.1	0.008	0.002	3.27E-07	0.103	4.80E-05
	Total (of product stage)	A1-3	2.18E+02	2.17E+02	0.535	0.054	2.93E-06	0.609	2.73E-03
Construction process stage	Transport	A4	43.0	43.0	0.010	7.22E-04	1.00E-06	0.082	2.77E-05
	Construction	A5	27.3	27.3	0.005	4.53E-04	6.27E-07	0.035	4.12E-05
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
<b>%92 Recycling / %8 Landfill Scenario</b>									
End of life	Deconstruction, demolition	C1	2.27	2.27	3.99E-04	9.35E-05	3.46E-08	0.021	2.14E-06
	Transport	C2	30.3	30.3	0.007	5.11E-04	7.03E-07	0.062	1.95E-05
	Waste processing	C3	0	0	0	0	0	0	0
	Disposal	C4	0.186	0.185	5.06E-04	1.16E-05	2.85E-09	0.002	1.78E-07
Potential benefits and loads beyond the system boundaries	Reuse, recovery, recycling potential	D	2.50E+02	2.49E+02	0.614	0.062	3.37E-06	0.700	3.13E-03
<b>100% Landfill Scenario</b>									
End of life	Deconstruction, demolition	C1	2.27	2.27	3.99E-04	9.35E-05	3.46E-08	0.021	2.14E-06
	Transport	C2	2.20	2.20	4.93E-04	3.64E-05	5.15E-08	0.003	1.41E-06
	Waste processing	C3	0	0	0	0	0	0	0
	Disposal	C4	2.32	2.32	6.33E-03	1.46E-04	3.56E-08	0.021	2.23E-06
Potential benefits and loads beyond the system boundaries	Reuse, recovery, recycling potential	D	4.12E+02	4.11E+02	1.01	0.102	5.55E-06	1.15	5.16E-03
<b>100% Recycling Scenario</b>									
End of life	Deconstruction, demolition	C1	2.27	2.27	3.99E-04	9.35E-05	3.46E-08	0.021	2.14E-06
	Transport	C2	36.2	36.2	0.008	6.10E-04	8.41E-07	0.074	2.33E-05
	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	2.36E+02	2.35E+02	0.580	0.059	3.18E-06	0.661	2.96E-03

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



# Environmental Product Declaration

## LCA Results (continued)

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

### Core environmental impact indicators

Life Cycle Stage	Impact Category		EP-marine	EP-terrestrial	POCP	ADP-mineral & metals	ADP-fossil	WDP
			kg N eq	mol N eq	kg NMVOC eq	kg Sb eq	MJ, net calorific value	m <sup>3</sup> world eq deprived
Product stage	Raw material supply	A1	0.122	1.31	0.481	1.51E-04	7.58E+03	79.8
	Transport	A2	0.007	0.080	0.049	4.47E-07	2.31E+02	0.190
	Manufacturing	A3	0.049	0.533	0.205	3.17E-07	2.81E+02	7.04
	Total (of product stage)	A1-3	0.178	1.92	0.735	1.52E-04	8.09E+03	87.0
Construction process stage	Transport	A4	0.018	0.202	0.125	1.14E-06	5.90E+02	0.468
	Construction	A5	0.008	0.090	0.070	6.10E-07	4.06E+02	0.899
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
<b>%92 Recycling / %8 Landfill Scenario</b>								
End of life	Deconstruction, demolition	C1	9.89E-03	0.108	0.032	7.96E-08	29.7	0.037
	Transport	C2	0.014	0.152	0.090	8.00E-07	4.15E+02	0.329
	Waste processing	C3	0	0	0	0	0	0
	Disposal	C4	7.90E-04	0.009	0.003	6.43E-09	2.43	0.004
Potential benefits and loads beyond the system boundaries	Reuse, recovery, recycling potential	D	0.205	2.21	0.845	1.74E-04	9.30E+03	1.00E+02
<b>100% Landfill Scenario</b>								
End of life	Deconstruction, demolition	C1	9.89E-03	0.108	0.032	7.96E-08	29.7	0.037
	Transport	C2	7.63E-04	0.008	0.006	5.90E-08	30.2	0.024
	Waste processing	C3	0	0	0	0	0	0
	Disposal	C4	0.010	0.108	0.032	8.03E-08	30.3	0.044
Potential benefits and loads beyond the system boundaries	Reuse, recovery, recycling potential	D	0.338	3.64	1.39	2.87E-04	1.53E+04	1.65E+02
<b>100% Recycling Scenario</b>								
End of life	Deconstruction, demolition	C1	9.89E-03	0.108	0.032	7.96E-08	29.7	0.037
	Transport	C2	0.017	0.182	0.108	9.57E-07	4.96E+02	0.393
	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	0.193	2.08	0.797	1.64E-04	8.78E+03	94.4

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.  
 The results of the three environmental impact indicators above shall be used with care as the uncertainties on these results are high or as there is limited experienced with these indicators.

EP-marine = Eutrophication potential, fraction of nutrients reaching marine end compartment;  
 EP-terrestrial = Eutrophication potential, accumulated exceedance;  
 POCP = Formation potential of tropospheric ozone;  
 PM = Particulate matter.



# Environmental Product Declaration

## LCA Results (continued)

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

### Parameters describing environmental impacts

Life Cycle Stage	Impact Category		PM	IRP	ETP-fw	HTP-c	HTP-nc	SQP
			disease incidence	kBq U <sup>235</sup> eq	CTUe	CTUh	CTUh	dimensionless
Product stage	Raw material supply	A1	1.75E-05	1.11E+02	473	3.22E-07	9.88E-06	147
	Transport	A2	1.30E-06	0.024	9.37	1.16E-09	1.42E-07	0.313
	Manufacturing	A3	3.27E-06	0.050	19.2	1.05E-07	1.32E-05	1.06
	Total (of product stage)	A1-3	2.20E-05	1.11E+02	5.02E+02	4.28E-07	2.32E-05	1.48E+02
Construction process stage	Transport	A4	3.32E-06	0.056	24	2.97E-09	3.65E-07	0.751
	Construction	A5	1.48E-06	0.258	14	1.75E-09	1.70E-07	0.790
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
<b>%92 Recycling / %8 Landfill Scenario</b>								
End of life	Deconstruction, demolition	C1	6.045E-07	2.47E-03	0.852	1.22E-10	2.24E-09	0.050
	Transport	C2	2.33E-06	0.040	16.7	2.10E-09	2.55E-07	0.528
	Waste processing	C3	0	0	0	0.00E+00	0	0
	Disposal	C4	4.93E-08	3.40E-04	0.070	1.04E-11	2.04E-10	2.99
Potential benefits and loads beyond the system boundaries	Reuse, recovery, recycling potential	D	2.53E-05	1.27E+02	5.77E+02	4.92E-07	2.67E-05	1.70E+02
<b>100% Landfill Scenario</b>								
End of life	Deconstruction, demolition	C1	6.04E-07	2.47E-03	0.852	1.22E-10	2.24E-09	0.050
	Transport	C2	1.71E-07	0.003	1.22	1.49E-10	1.88E-08	0.0384
	Waste processing	C3	0	0	0	0	0	0
	Disposal	C4	6.16E-07	0.004	0.874	1.30E-10	2.55E-09	37.3
Potential benefits and loads beyond the system boundaries	Reuse, recovery, recycling potential	D	4.17E-05	2.09E+02	9.50E+02	8.10E-07	4.40E-05	2.81E+02
<b>100% Recycling Scenario</b>								
End of life	Deconstruction, demolition	C1	6.04E-07	2.47E-03	0.852	1.22E-10	2.24E-09	0.050
	Transport	C2	2.78E-06	0.047	19.9	2.51E-09	3.05E-07	0.631
	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	2.39E-05	1.20E+02	5.44E+02	4.64E-07	2.52E-05	1.61E+02

IRP = Potential human exposure efficiency relative to U235; 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.

HTP-nc = Potential comparative toxic unit for humans; and ETP-fw = Potential comparative toxic unit for ecosystems; HTP-c = Potential comparative toxic unit for humans; SQP = Potential soil quality index. The results of the four environmental impact indicators above shall be used with care as the uncertainties on these results are high or as there is limited experienced with these indicators.



# Environmental Product Declaration

## LCA Results (continued)

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

Parameters describing resource use								
Life Cycle Stage	Impact Category		PERE	PERM	PERT	PENRE	PENRM	PENRT
			MJ	MJ	MJ	MJ	MJ	MJ
Product stage	Raw material supply	A1	1.03E+02	0	1.03E+02	7.58E+03	0	7.58E+03
	Transport	A2	0.623	0	0.623	2.31E+02	0	2.31E+02
	Manufacturing	A3	1.47	0	1.47	2.81E+02	0	2.81E+02
	Total (of product stage)	A1-3	1.06E+02	0	1.06E+02	8.09E+03	0	8.09E+03
Construction process stage	Transport	A4	1.47	0	1.47	5.90E+02	0	5.90E+02
	Construction	A5	0.761	0	0.761	4.06E+02	0	4.06E+02
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
<b>%92 Recycling / %8 Landfill Scenario</b>								
End of life	Deconstruction, demolition	C1	0.065	0	0.065	29.7	0	29.7
	Transport	C2	1.03	0	1.03	4.15E+02	0	4.15E+02
	Waste processing	C3	0	0	0	0	0	0
	Disposal	C4	0.067	0	0.067	2.4	0	2.43
Potential benefits and loads beyond the system boundaries	Reuse, recovery, recycling potential	D	121	0	121	9.30E+03	0	9.30E+03
<b>100% Landfill Scenario</b>								
End of life	Deconstruction, demolition	C1	0.065	0	0.065	29.7	0	29.7
	Transport	C2	0.075	0	0.075	30.2	0	30.2
	Waste processing	C3	0	0	0	0	0	0
	Disposal	C4	0.833	0	0.833	30.3	0	30.3
Potential benefits and loads beyond the system boundaries	Reuse, recovery, recycling potential	D	2.00E+02	0	2.00E+02	1.53E+04	0	1.53E+04
<b>100% Recycling Scenario</b>								
End of life	Deconstruction, demolition	C1	0.065	0	0.065	29.7	0	29.7
	Transport	C2	1.23	0	1.23	4.96E+02	0	4.96E+02
	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	114	0	114	8.78E+03	0	8.78E+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



# Environmental Product Declaration

## LCA Results (continued)

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

Parameters describing resource use						
Life Cycle Stage	Impact Category		SM	RSF	NRSF	FW
			kg	MJ net calorific value	MJ net calorific value	m <sup>3</sup>
Product stage	Raw material supply	A1	0	0	0	2.20
	Transport	A2	0	0	0	0.005
	Manufacturing	A3	1.09E+03	0	0	0.371
	Total (of product stage)	A1-3	1.09E+03	0	0	2.57
Construction process stage	Transport	A4	0	0	0	0.011
	Construction	A5	0	0	0	0.021
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
<b>%92 Recycling / %8 Landfill Scenario</b>						
End of life	Deconstruction, demolition	C1	0	0	0	9.00E-04
	Transport	C2	0	0	0	0.008
	Waste processing	C3	0	0	0	0
	Disposal	C4	0	0	0	8.84E-05
Potential benefits and loads beyond the system boundaries	Reuse, recovery, recycling potential	D	1.63E+02	0	0	2.96
<b>100% Landfill Scenario</b>						
End of life	Deconstruction, demolition	C1	0	0	0	9.00E-04
	Transport	C2	0	0	0	5.86E-04
	Waste processing	C3	0	0	0	0
	Disposal	C4	0	0	0	1.11E-03
Potential benefits and loads beyond the system boundaries	Reuse, recovery, recycling potential	D	9.74E+02	0	0	4.87
<b>100% Recycling Scenario</b>						
End of life	Deconstruction, demolition	C1	0	0	0	9.00E-04
	Transport	C2	0	0	0	0.010
	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	92.3	0	0	2.79

SM = Use of secondary material;  
RSF = Use of renewable secondary fuels;

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



# Environmental Product Declaration

## LCA Results (continued)

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

Other environmental information describing waste categories					
Life Cycle Stage	Impact Category		HWD	NHWD	RWD
			kg	kg	kg
Product stage	Raw material supply	A1	32.4	2.19E+02	0.090
	Transport	A2	9.97E-03	0.802	1.47E-05
	Manufacturing	A3	0.078	2.18	3.03E-05
	Total (of product stage)	A1-3	1.22E-06	79.5	0.205
Construction process stage	Transport	A4	0.023	1.91	3.54E-05
	Construction	A5	0.093	2.39	2.04E-04
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
<b>%92 Recycling / %8 Landfill Scenario</b>					
End of life	Deconstruction, demolition	C1	0.003	0.107	1.39E-06
	Transport	C2	0.016	1.34	2.48E-05
	Waste processing	C3	0	0	0
	Disposal	C4	2.52E-04	0.009	1.86E-07
Potential benefits and loads beyond the system boundaries	Reuse, recovery, recycling potential	D	37.390	2.55E+02	0.104
<b>100% Landfill Scenario</b>					
End of life	Deconstruction, demolition	C1	0.003	0.107	1.39E-06
	Transport	C2	1.17E-03	0.098	1.82E-06
	Waste processing	C3	0	0	0
	Disposal	C4	3.15E-03	0.113	2.32E-06
Potential benefits and loads beyond the system boundaries	Reuse, recovery, recycling potential	D	61.6	4.20E+02	0.171
<b>100% Recycling Scenario</b>					
End of life	Deconstruction, demolition	C1	3.12E-03	0.107	1.39E-06
	Transport	C2	0.020	1.60	2.97E-05
	Waste processing	C3	0	0	0
	Disposal	C4	0	0	0
Potential benefits and loads beyond the system boundaries	Reuse, recovery, recycling potential	D	35.3	2.41E+02	0.098

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



# Environmental Product Declaration

## 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

Life Cycle Stage	Impact Category		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	0	0	0	0	0	0
	Construction	A5	0	118	0	0	0	0
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
<b>%92 Recycling / %8 Landfill Scenario</b>								
End of life	Deconstruction, demolition	C1	0	811	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
<b>100% Landfill Scenario</b>								
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
<b>100% Recycling Scenario</b>								
End of life	Deconstruction, demolition	C1	0	882	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
Module A4 Transport to the Building Site	On leaving the steelworks the reinforcing steel products 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	litre/km	1.56
	Distance	km	350
	Capacity utilisation (including empty returns)	%	85
	Bulk density of transported products	kg/m <sup>3</sup>	7850
Module 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 and welding. 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). Residual grid mix of United Arab Emirates has been selected to suit specific fabrication and installation location. Fabrication into structural 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
Module B2 Maintenance	No maintenance required.		
Module B3 Repair	No repair process required.		
Module B4 Replacement	No replacement considerations required.		
Module 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. BS EN 1990 specifies "building structures and other common structures" as having a lifetime of 50 years. On this basis, the RSL for this EPD is assumed to be 50 years.		
Module B6 Use of Energy	No energy required during use stage related to the operation of the building.		
Module B7 Use of Water	No water required during use stage related to the operation of the building.		
Modules 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 reinforcing steel is assumed to be recycled and 8% is sent to landfill [STEELCONSTRUCTION.INFO 2012]. The EPD covers transport to, and end-of-life in United Arab Emirates. 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	%	2
	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	%	90
	Transport to waste processing by Truck - Density of Product	kg/m <sup>3</sup>	7850



# Environmental Product Declaration

## Scenarios and additional technical information

Scenario	Parameter	Units	Results
	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 <sup>3</sup>	7850
Module D	<p>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 or in IF 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.</p> <p>This study is concerned with the secondary production route and more scrap is required as input to the system than is recovered at end of life. The net effect of this is that module D mainly models the burdens associated with the scrap input (secondary material) to the steelmaking process.</p> <p>The resulting scrap credit/burden is calculated based on the global "value of scrap" approach (/worldsteel 2011).</p>		
	Recycled Content	kg	978
	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

Scrap based reinforcing steel product of Arabian Gulf Steel Industries LLC is made via the Induction Furnace production 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.

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 67.88% 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. For overall climate change impacts, carbon dioxide emissions account for the majority of impacts with methane being the second most significant contributor.

#### 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.

#### Acidification Potential (AP)

Acidification potential is generally driven by the production of sulphur dioxide and nitrogen oxides through the combustion of fossil fuels, particularly coal and crude oil products. 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.

#### Eutrophication Potential (EP)

Eutrophication is driven by nitrogen and phosphorus containing emissions and as with GWP and AP is often strongly linked with the use of fossil fuels. 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.

#### Photochemical Ozone Creation Potential (POCP)

POCP tends to be driven by emissions of carbon monoxide, nitrogen oxides (NO<sub>x</sub>), sulphur dioxide and NMVOCs. 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



# Environmental Product Declaration

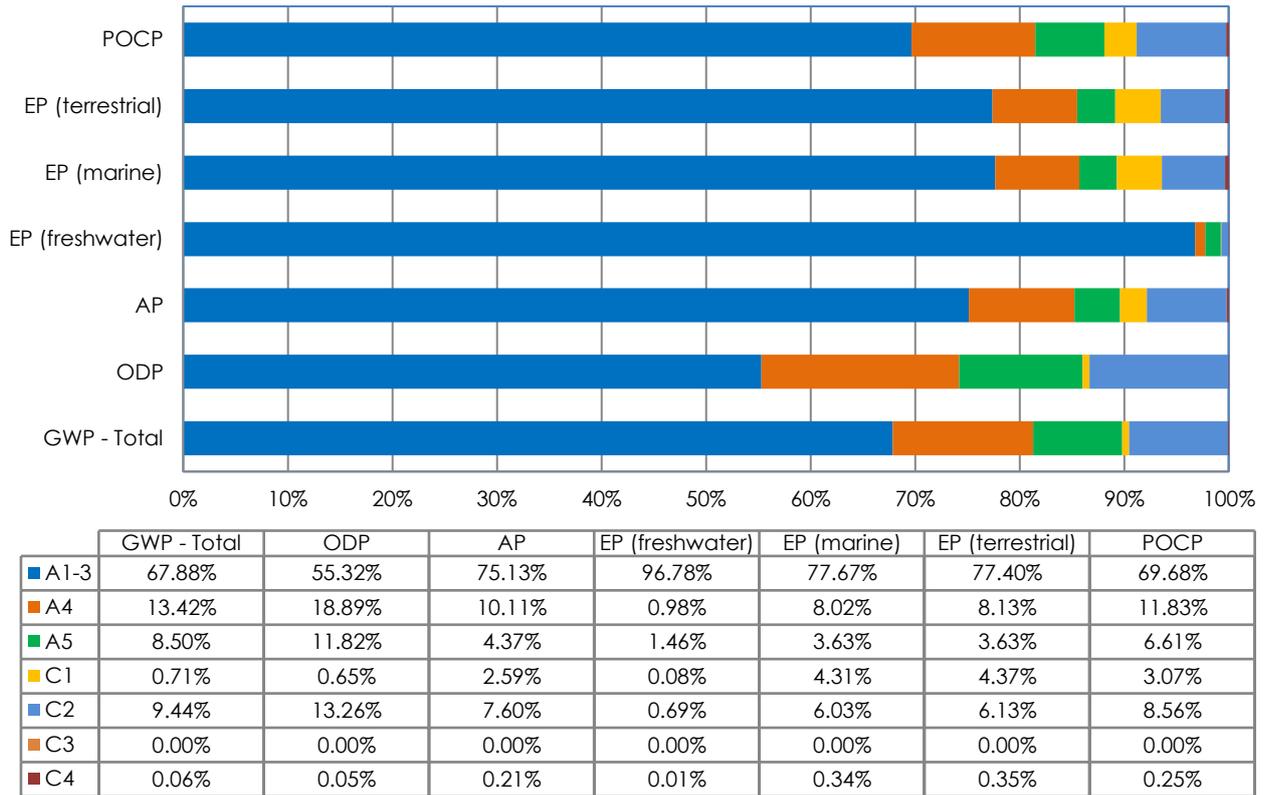


Figure 1 - shows the relative contribution of each life cycle stage to different environmental indicators for the carbon steel reinforcing bars manufactured by the secondary production route (scrap)

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