



# Environmental Product Declaration

## Statement of Verification

CARES EPD No.: 0020

Issue 01

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

Provided by:  
Modern Steel Mills LLC

Is in accordance with the requirements of:  
ISO 14025:2010 and EN 15804:2012 + A2:2019/AC2021  
and BRE Global PCR for Type III EPD of Construction Products  
to EN 15804+A2. PN514 3.1

This declaration is for:  
Carbon Steel Billet (Secondary production route - scrap)



## Company address:

Post Box 174. Postal Code 124,  
Plot No-80/1 Rusayl Industrial  
Estate, Road No.17  
Sultanate of Oman



**Modern Steel Mills L.L.C**



*LadinCamci*

Ladin Camci

25 April 2025

Signed for CARES

Operator

Date of this Issue

25 April 2025

24 April 2028

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 0020

### 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>	BRE Global Product Category Rules (PCR) for Type III EPD of Construction Products to EN 15804+A2. PN514 3.1
<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 EPD Tool version 2.8 SPHERA SOLUTIONS UK LIMITED The Innovation Centre Warwick Technology Park, Gallows Hill, Warwick, Warwickshire CV34 6UW UK <a href="http://www.sphera.com">www.sphera.com</a>
<b>Declared/Functional Unit</b>	1 tonne of carbon steel billet 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 Modules C1-C4 and Module D
<b>Background database</b>	LCA FE (GaBi) Dataset Documentation (Sphera 2023.1)

### 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
✓	✓	✓	ND	ND	ND	ND	ND	ND	ND	ND	ND	✓	✓	✓	✓	✓

Note: Checks indicate the Information Modules declared.

## Manufacturing site

Modern Steel Mills LLC  
Post Box 174, Postal Code 124, Plot No-80/1  
Rusayl Industrial Estate, Road No.17  
Sultanate of Oman

## Construction Product:

### Product Description

Carbon Steel Billet is non-alloy or low-alloy steel semi-product. Carbon steel billets (according to product standards listed in Summary, Comments and Additional Information) that are manufactured by melting scrap in an EAF (Electric Arc Furnace), followed by continuous casting.

Carbon steel billet is used as raw material in the hot rolling process to produce reinforcing steels or wire rods for direct use or to produce wire rods for further processing into reinforcing steels or other structural steel forms.

The declared unit is 1 tonne of carbon steel billets manufactured by the secondary (scrap-based) production route.



# Environmental Product Declaration

## Technical Information

Property	Value, Unit
Production route	EAF
Density	7850 kg/m <sup>3</sup>
Recycled content (as per ISO 14021:2016/Amd:2021)	81.7 % (Including internal and external scrap) 81.2 % (Including external scrap only)

## Main Product Contents

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

## Manufacturing Process

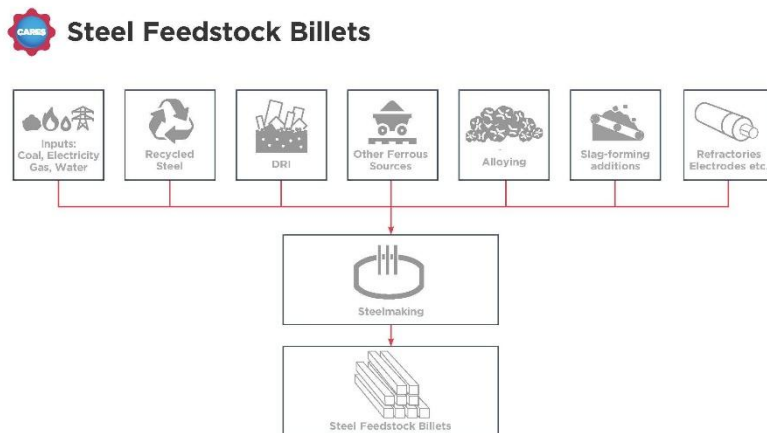
Steel scrap (a limited amount of DRI can also be added) is melted in an EAF (Electric Arc Furnace) to obtain liquid metal. This is then refined through secondary metallurgy processes to remove impurities and make alloying additions to give the steel the required properties.

Refined liquid steel is then cast into steel billets in required dimensions to be used as feedstock for the manufacture of rolled constructional steel products.

Steel billets are hot rolled and shaped to the required dimensions for the finished bars of reinforcing steel bar, coil or rod for the reinforcement of concrete for direct use or wire rod for further processing into other reinforcing standards or other forms of structural steels as used in a built structure.

The carbon steel billet products may be packaged by binding with steel wire or straps, either of the steel ties and products do not include any biogenic materials.

## Process flow diagram





## Construction Installation

Processing and proper use of reinforcing steel and structural steel products manufactured from carbon steel billets 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 and structural steel products the usual requirement for securing loads is to be observed.

## Use Information

The composition of the reinforcing steel and other structural steel products manufactured from carbon steel billets does not change during use.

Carbon steel reinforcing steel and other structural 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 and structural steel product itself.

## End of Life

Reinforcing steel and other structural steel products manufactured from carbon steel feedstock billets 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 uses the "Cut-off by Classification" method, also known as the recycled content method. It assigns the environmental impacts of primary material production to the initial user. Recyclable materials enter the recycling process without burdens, and secondary materials only bear the impacts of recycling.

This method promotes recycling by making producers responsible for waste management. It supports a circular economy by reducing the environmental impacts of primary material production.

This approach follows ISO 14040 and ISO 14044 standards for Life Cycle Assessments.

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 v3.0 (EF 3.0) was applied.

## Declared unit description

1 tonne of carbon steel billet manufactured by 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 modules A1 to A3, 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.

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 and Quality:

The selection of data and the data quality requirements have been provided according to the requirements of BS EN 15941:2024.

Data Sources: Manufacturing data of the period 01/01/2024 - 31/12/2024 has been provided by Modern Steel Mills LLC operating on the geographical area noted in Manufacturing Site. 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 Oman.

The selection of the background data for electricity generation is in line with the BRE Global PCR PN514 3.1. Country or region-specific power grid mixes are selected from LCA FE (GaBi) Dataset Documentation (Sphera 2023.1); thus, consumption grid mix of Oman has been selected to suit specific manufacturing location, and also for fabrication, installation and demolishing location. The emission factor of carbon footprint of the applied consumption grid mix of Oman is 0.607 kg CO<sub>2</sub> eq/kWh.

Data Quality: Background data is consistently sourced from the LCA FE (GaBi) Dataset Documentation (Sphera 2023.1). The primary data collection was thorough, considering all relevant flows and these data have been verified during the audit conducted by CARES in March 2025.

There isn't any data from different LCI/LCA databases are used considering that the overall consistency of the study is not adversely affected.

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 fair, 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:

Slag from EAF process 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 EAF slag are 0.04% and 0.25% 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 LCA FE (GaBi) Dataset Documentation (Sphera 2023.1).

## 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 bundle is less than 1 % of the total mass of the product.



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## LCA Results

(ND = 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 CO <sub>2</sub> eq	kg CO <sub>2</sub> eq	kg CO <sub>2</sub> eq	kg CFC11 eq	mol H <sup>+</sup> eq	Kg P eq
Product stage	Raw material supply	A1	342	342	-0.386	0.175	3.65E-10	1.15	3.41E-04
	Transport	A2	12.5	12.5	-0.151	0.100	1.05E-12	0.086	3.98E-05
	Manufacturing	A3	500	500	-0.116	0.017	1.76E-11	1.78	2.53E-05
	Total (of product stage)	A1-3	8.55E+02	8.55E+02	-0.653	0.292	3.84E-10	3.02	4.06E-04
Construction process stage	Transport	A4	ND	ND	ND	ND	ND	ND	ND
	Construction	A5	ND	ND	ND	ND	ND	ND	ND
Use stage	Use	B1	ND	ND	ND	ND	ND	ND	ND
	Maintenance	B2	ND	ND	ND	ND	ND	ND	ND
	Repair	B3	ND	ND	ND	ND	ND	ND	ND
	Replacement	B4	ND	ND	ND	ND	ND	ND	ND
	Refurbishment	B5	ND	ND	ND	ND	ND	ND	ND
	Operational energy use	B6	ND	ND	ND	ND	ND	ND	ND
	Operational water use	B7	ND	ND	ND	ND	ND	ND	ND
<b>%92 Recycling / %8 Landfill Scenario</b>									
End of life	Deconstruction, demolition	C1	2.05	2.05	8.04E-04	4.51E-05	6.29E-14	0.011	2.45E-07
	Transport	C2	41.4	41.9	-0.898	0.407	4.04E-12	0.193	1.61E-04
	Waste processing	C3	0	0	0	0	0	0	0
	Disposal	C4	1.17	1.20	-0.040	0.004	3.05E-12	0.009	2.42E-06
Potential benefits and loads beyond the system boundaries	Reuse, recovery, recycling potential	D	76.2	76.3	-0.149	0.032	-2.24E-10	0.172	5.64E-06
<b>100% Landfill Scenario</b>									
End of life	Deconstruction, demolition	C1	2.05	2.05	8.04E-04	4.51E-05	6.29E-14	0.011	2.45E-07
	Transport	C2	1.89	1.92	-0.044	0.020	1.88E-13	0.007	7.83E-06
	Waste processing	C3	0	0	0	0	0	0	0
	Disposal	C4	14.6	15.0	-0.499	0.047	3.82E-11	0.107	3.02E-05
Potential benefits and loads beyond the system boundaries	Reuse, recovery, recycling potential	D	2.14E+03	2.15E+03	-4.19	0.890	-6.30E-09	4.83	1.59E-04
<b>100% Recycling Scenario</b>									
End of life	Deconstruction, demolition	C1	2.05	2.05	8.04E-04	4.51E-05	6.29E-14	0.011	2.45E-07
	Transport	C2	44.8	45.3	-0.973	0.440	4.37E-12	0.209	1.74E-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	-104	-104	0.203	-0.043	3.04E-10	-0.234	-7.68E-06

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)

(ND = 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	0.028	2.50	0.681	2.02E-04	4.54E+03	30.6
	Transport	A2	0.028	0.308	0.066	7.13E-07	166	0.127
	Manufacturing	A3	0.423	4.63	1.22	9.61E-07	7.43E+03	1.96
	Total (of product stage)	A1-3	0.478	7.44	1.97	2.04E-04	1.21E+04	32.7
Construction process stage	Transport	A4	ND	ND	ND	ND	ND	ND
	Construction	A5	ND	ND	ND	ND	ND	ND
Use stage	Use	B1	ND	ND	ND	ND	ND	ND
	Maintenance	B2	ND	ND	ND	ND	ND	ND
	Repair	B3	ND	ND	ND	ND	ND	ND
	Replacement	B4	ND	ND	ND	ND	ND	ND
	Refurbishment	B5	ND	ND	ND	ND	ND	ND
	Operational energy use	B6	ND	ND	ND	ND	ND	ND
	Operational water use	B7	ND	ND	ND	ND	ND	ND
<b>%92 Recycling / %8 Landfill Scenario</b>								
End of life	Deconstruction, demolition	C1	0.004	0.044	0.011	1.25E-08	27.6	0.016
	Transport	C2	0.091	1.01	0.195	2.86E-06	633	0.511
	Waste processing	C3	0	0	0	0	0	0
	Disposal	C4	0.002	0.024	0.007	5.54E-08	16.0	0.132
Potential benefits and loads beyond the system boundaries	Reuse, recovery, recycling potential	D	0.041	0.45	0.137	7.91E-07	564	1.08
<b>100% Landfill Scenario</b>								
End of life	Deconstruction, demolition	C1	0.004	0.044	0.011	1.25E-08	27.6	0.016
	Transport	C2	0.003	0.036	0.006	1.38E-07	29.2	0.025
	Waste processing	C3	0	0	0	0	0	0
	Disposal	C4	0.028	0.303	0.083	6.92E-07	200	1.65
Potential benefits and loads beyond the system boundaries	Reuse, recovery, recycling potential	D	1.16	12.6	3.86	2.23E-05	1.59E+04	30.5
<b>100% Recycling Scenario</b>								
End of life	Deconstruction, demolition	C1	0.004	0.044	0.011	1.25E-08	27.6	0.016
	Transport	C2	0.098	1.10	0.212	3.10E-06	685	0.553
	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	-0.056	-0.607	-0.187	-1.08E-06	-767	-1.48

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)

(ND = 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	1.42E-05	7.17	3.41E-04	2.86E-08	1.55E-06	665
	Transport	A2	1.12E-06	0.031	3.98E-05	2.33E-09	1.41E-07	61.5
	Manufacturing	A3	1.32E-05	0.127	2.53E-05	1.14E-07	9.29E-07	18.0
	Total (of product stage)	A1-3	2.85E-05	7.33	4.06E-04	1.45E-07	2.62E-06	7.45E+02
Construction process stage	Transport	A4	ND	ND	ND	ND	ND	ND
	Construction	A5	ND	ND	ND	ND	ND	ND
Use stage	Use	B1	ND	ND	ND	ND	ND	ND
	Maintenance	B2	ND	ND	ND	ND	ND	ND
	Repair	B3	ND	ND	ND	ND	ND	ND
	Replacement	B4	ND	ND	ND	ND	ND	ND
	Refurbishment	B5	ND	ND	ND	ND	ND	ND
	Operational energy use	B6	ND	ND	ND	ND	ND	ND
	Operational water use	B7	ND	ND	ND	ND	ND	ND
<b>%92 Recycling / %8 Landfill Scenario</b>								
End of life	Deconstruction, demolition	C1	6.69E-08	5.08E-04	2.45E-07	6.18E-10	1.84E-08	0.043
	Transport	C2	1.52E-06	0.117	1.61E-04	8.94E-09	5.22E-07	249
	Waste processing	C3	0	0	0	0	0	0
	Disposal	C4	1.05E-07	0.021	2.42E-06	1.34E-09	1.48E-07	3.89
Potential benefits and loads beyond the system boundaries	Reuse, recovery, recycling potential	D	2.51E-06	-1.11	5.64E-06	1.17E-07	4.55E-07	-53.1
<b>100% Landfill Scenario</b>								
End of life	Deconstruction, demolition	C1	6.69E-08	5.08E-04	2.45E-07	6.18E-10	1.84E-08	0.043
	Transport	C2	3.65E-08	5.46E-03	7.83E-06	4.14E-10	2.45E-08	12.2
	Waste processing	C3	0	0	0	0	0	0
	Disposal	C4	1.31E-06	0.263	3.02E-05	1.68E-08	1.85E-06	48.6
Potential benefits and loads beyond the system boundaries	Reuse, recovery, recycling potential	D	7.06E-05	-31.2	1.59E-04	3.30E-06	1.28E-05	-1.49E+03
<b>100% Recycling Scenario</b>								
End of life	Deconstruction, demolition	C1	6.69E-08	5.08E-04	2.45E-07	6.18E-10	1.84E-08	0.043
	Transport	C2	1.65E-06	0.127	1.74E-04	9.68E-09	5.65E-07	270
	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	-3.41E-06	1.51	-7.68E-06	-1.60E-07	-6.19E-07	72.2

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)

(ND = 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	363	0	363	4.55E+03	0	4.55E+03
	Transport	A2	10.5	0	10.5	166	0	166
	Manufacturing	A3	12	0	12	7.43E+03	0	7.43E+03
	Total (of product stage)	A1-3	3.86E+02	0	3.86E+02	1.21E+04	0	1.21E+04
Construction process stage	Transport	A4	ND	ND	ND	ND	ND	ND
	Construction	A5	ND	ND	ND	ND	ND	ND
Use stage	Use	B1	ND	ND	ND	ND	ND	ND
	Maintenance	B2	ND	ND	ND	ND	ND	ND
	Repair	B3	ND	ND	ND	ND	ND	ND
	Replacement	B4	ND	ND	ND	ND	ND	ND
	Refurbishment	B5	ND	ND	ND	ND	ND	ND
	Operational energy use	B6	ND	ND	ND	ND	ND	ND
	Operational water use	B7	ND	ND	ND	ND	ND	ND
<b>%92 Recycling / %8 Landfill Scenario</b>								
End of life	Deconstruction, demolition	C1	0.049	0	0.049	27.6	0	27.6
	Transport	C2	42.4	0	42.4	634	0	634
	Waste processing	C3	0	0	0	0	0	0
	Disposal	C4	2.61	0	2.61	16.0	0	16.0
Potential benefits and loads beyond the system boundaries	Reuse, recovery, recycling potential	D	-93.8	0	-93.8	570	0	570
<b>100% Landfill Scenario</b>								
End of life	Deconstruction, demolition	C1	0.049	0	0.049	27.6	0	27.6
	Transport	C2	2.07	0	2.07	29.3	0	29.3
	Waste processing	C3	0	0	0	0	0	0
	Disposal	C4	32.6	0	32.6	200	0	200
Potential benefits and loads beyond the system boundaries	Reuse, recovery, recycling potential	D	-2.64E+03	0	-2.64E+03	1.61E+04	0	1.61E+04
<b>100% Recycling Scenario</b>								
End of life	Deconstruction, demolition	C1	0.049	0	0.049	27.6	0	27.6
	Transport	C2	45.9	0	45.9	687	0	687
	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	128.0	0	128.0	-776	0	-776

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)

(ND = 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	30.6
	Transport	A2	0	0	0	0.127
	Manufacturing	A3	972	0	0	1.96
	Total (of product stage)	A1-3	972	0	0	32.7
Construction process stage	Transport	A4	ND	ND	ND	ND
	Construction	A5	ND	ND	ND	ND
Use stage	Use	B1	ND	ND	ND	ND
	Maintenance	B2	ND	ND	ND	ND
	Repair	B3	ND	ND	ND	ND
	Replacement	B4	ND	ND	ND	ND
	Refurbishment	B5	ND	ND	ND	ND
	Operational energy use	B6	ND	ND	ND	ND
	Operational water use	B7	ND	ND	ND	ND
<b>%92 Recycling / %8 Landfill Scenario</b>						
End of life	Deconstruction, demolition	C1	0	0	0	0.016
	Transport	C2	0	0	0	0.511
	Waste processing	C3	0	0	0	0
	Disposal	C4	0	0	0	0.132
Potential benefits and loads beyond the system boundaries	Reuse, recovery, recycling potential	D	-51.6	0	0	1.08
<b>100% Landfill Scenario</b>						
End of life	Deconstruction, demolition	C1	0	0	0	0.016
	Transport	C2	0	0	0	0.025
	Waste processing	C3	0	0	0	0
	Disposal	C4	0	0	0	1.65
Potential benefits and loads beyond the system boundaries	Reuse, recovery, recycling potential	D	-972	0	0	30.5
<b>100% Recycling Scenario</b>						
End of life	Deconstruction, demolition	C1	0	0	0	0.016
	Transport	C2	0	0	0	0.553
	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	28.4	0	0	-1.48

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)

(ND = 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	1.30E-07	3.00	0.062
	Transport	A2	6.04E-10	0.023	2.13E-04
	Manufacturing	A3	3.88E-07	195	9.51E-04
	Total (of product stage)	A1-3	5.19E-07	198.0	0.063
Construction process stage	Transport	A4	ND	ND	ND
	Construction	A5	ND	ND	ND
Use stage	Use	B1	ND	ND	ND
	Maintenance	B2	ND	ND	ND
	Repair	B3	ND	ND	ND
	Replacement	B4	ND	ND	ND
	Refurbishment	B5	ND	ND	ND
	Operational energy use	B6	ND	ND	ND
	Operational water use	B7	ND	ND	ND
<b>%92 Recycling / %8 Landfill Scenario</b>					
End of life	Deconstruction, demolition	C1	1.57E-11	0.004	7.03E-06
	Transport	C2	2.30E-09	0.090	8.15E-04
	Waste processing	C3	0	0	0
	Disposal	C4	3.49E-10	80.1	1.82E-04
Potential benefits and loads beyond the system boundaries	Reuse, recovery, recycling potential	D	1.44E-09	1.13	-0.010
<b>100% Landfill Scenario</b>					
End of life	Deconstruction, demolition	C1	1.57E-11	0.004	7.03E-06
	Transport	C2	1.08E-10	0.004	3.78E-05
	Waste processing	C3	0	0	0
	Disposal	C4	4.36E-09	1.00E+03	0.002
Potential benefits and loads beyond the system boundaries	Reuse, recovery, recycling potential	D	4.05E-08	31.9	-0.282
<b>100% Recycling Scenario</b>					
End of life	Deconstruction, demolition	C1	1.57E-11	0.004	7.03E-06
	Transport	C2	2.49E-09	0.097	8.82E-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	-1.96E-09	-1.54	0.014

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



# Environmental Product Declaration

## LCA Results (continued)

(ND = 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	ND	ND	ND	ND	ND	ND
	Construction	A5	ND	ND	ND	ND	ND	ND
Use stage	Use	B1	ND	ND	ND	ND	ND	ND
	Maintenance	B2	ND	ND	ND	ND	ND	ND
	Repair	B3	ND	ND	ND	ND	ND	ND
	Replacement	B4	ND	ND	ND	ND	ND	ND
	Refurbishment	B5	ND	ND	ND	ND	ND	ND
	Operational energy use	B6	ND	ND	ND	ND	ND	ND
	Operational water use	B7	ND	ND	ND	ND	ND	ND
<b>%92 Recycling / %8 Landfill Scenario</b>								
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
	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
	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	1.00E+03	0	0	0	0
	Transport	C2	0	0	0	0	0	0
	Waste processing	C3	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
Modules C1 to C4 End of life	<p>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 Oman.</p> <p>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.</p>		
	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	%	85
	Transport to waste processing by Truck - Density of Product	kg/m <sup>3</sup>	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
Module D	<p>Transport to waste processing by Container ship - Density of Product</p>		
	<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 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 billets manufactured from secondary production route in which steel scrap is the main ferrous charge to the EAF, and a limited amount of DRI can also be used. In secondary production route using steel scrap only, more scrap is required as input to the system than is recovered at end of life. In DRI production route, a large amount of net scrap is generated over the life cycle as the iron ore used to obtain DRI is a virgin source and there is a high end of life recycling rate for reinforcing steel products. As majority of the raw material is the steel scrap, the net effect 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	812
	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

The production stage (A1-A3) is the most important module for climate change, eutrophication freshwater, resource use (mineral and metals) and resource use (energy carriers) as well as water scarcity

Module D presents a significant credit in all impact categories, except for ODP. Impacts from other life cycle stages are negligible in comparison.

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# Environmental Product Declaration

Sustainability of construction works - Environmental product declarations - Methodology for selection and use of generic data; German version CEN/TR 15941

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