

Environmental Product Declaration

Average of Finished Long Products (Steel)

ISO 14020:2000, ISO 14025:2006, ISO 14040:2006, ISO 14044:2006, EN 15804:2012+A2:2019

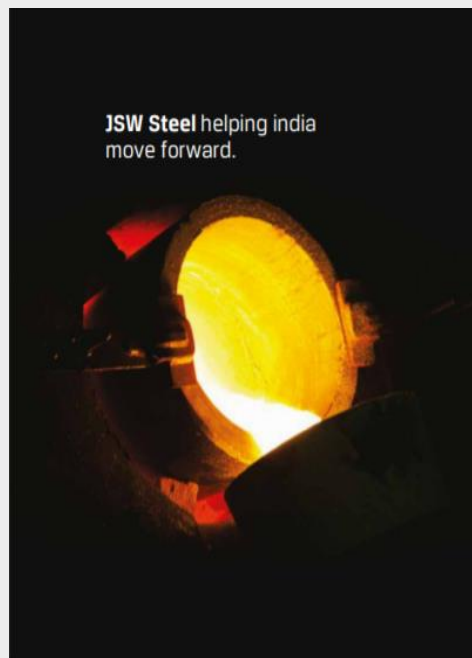


EPD registration number	Publication date	Validity date	Geographical scope
S-P-04326	2021-10-21	2026-10-20	India

1. Introduction

Founded in 1982, JSW Group is one of India's largest business conglomerates. It is a part of the US \$13 billion O. P. Jindal Group. JSW Steel, the flagship company of JSW group, is India's leading primary and integrated steel producer. It is one of the fastest growing companies in India with a footprint in over 140 countries. JSW steel have 13 Iron ore mines across Karnataka and Odisha and six manufacturing locations across India – Vijayanagar in Karnataka, Salem in Tamil Nadu, and Tarapur, Vasind, Kalmeshwar and Dolvi in Maharashtra. It is India's leading integrated steel company with an 18 MTPA crude steel capacity across three integrated steel plants at Vijayanagar, Dolvi and Salem. JSW Steel will continue to raise the bar with its high quality & diverse product range.

JSW Steel manufactures Finished Long products (TMT Bar, Wire Rod, Hot Rolled Wire Rod Coil, Hot Rolled Bar, Hot Rolled Hexagon Wire Rod Coil, Hot Rolled Hexagon Bar, Hot Rolled Round Cornered Square (RCS), Heat Treated Wire Rod Coil, Heat Treated Bar) in Deep Drawing, Extra Deep Drawing, Interstitial Free Steels and High Strength grades, which are conformed to JIS, EN, ASTM and IS standards. Dimensional accuracy is guaranteed by an automatic thickness control system using advanced numerical models. Easy formability, High quality Surface Finish, consistent surface texture with the optimum balance between texture for paint keying and smoothness (for image distinction) makes JSW's Finished Long Products the products of choice for automobiles, Building and construction, appliances, furniture, and many other applications.



2. General Information

2.1 EPD, PCR, LCA Information

Table 1. EPD Information

Programme	The International EPD® System, Indian Regional Hub www.environdec.com and www.environdecindia.com
Program operator	EPD International AB Box 210 60, SE-100 31 Stockholm, Sweden.
Declaration holder	JSW Steel Limited JSW Centre - 6th Floor, Bandra Kurla Complex Bandra (East), Mumbai – 400051, Maharashtra
Product	Finished Long Products (Steel) (TMT bar, Wire rod, Hot rolled wire rod coil, Hot rolled bar, Hot rolled hexagon wire rod coil, Hot rolled hexagon bar, Hot rolled round cornered square, Heat treated wire rod coil, Heat treated bar)
CPC Code	41244 (Version 2.1)
EPD registration number	S-P-04326
Publication date	2021-10-08
Validity date	2026-10-07
Geographical scope	India
Reference standards	ISO 14020:2001, ISO 14025:2006, EN 15804:2012+A2:2019

Table 2. PCR Information

Reference PCR	PCR 2019:14 - 'Construction products' Version 1.11, 2019
Date of Issue	2021-02-05 (Version 1.11)

Table 3. Verification Information

Demonstration of verification	External, independent verification
Third party verifier	Dr Hüdaï Kara, Metsims Sustainability Consulting, 4 Clear Water Place, Oxford OX2 7NL, UK Email: hudai.kara@metsims.com

Table 4. LCA Information

Title	Environmental Product Declaration of Average of Finished Long Products (Steel)
Preparer	Dr. Rajesh Kumar Singh thinkstep Sustainability Solutions Pvt. Ltd., a Sphera Company 707, Meadows, Sahar Plaza, Andheri Kurla Road, Andheri East, Mumbai, India - 400059 Email: RSingh@sphera.com 
Reference standards	ISO 14040/44 standard

2.2 Reference Period of EPD Data

The reference period for the primary data used within this EPD is the April 2019 to March 2020. The secondary data used in EPD is less than 10 years old.

2.3 Geographical Scope of EPD Application

The geographical scope of this EPD is India.

2.4 Additional Information about EPD

This EPD provides information for the Average of 10 Finished Long Products of JSW Steel Limited's manufacturing plants in Vijayanagar (India), Dolvi (India), and Salem (India). The EPD is in accordance with ISO 14025 and EN 15804:2012+A2:2019.. The Life Cycle Assessment (LCA) study carried out for developing this EPD is as per ISO 14040 and ISO 14044 standards.

The target audience includes JSW management, operational and marketing departments. Furthermore, it will be made available for many different external applications, for technical and non-technical people, including customers, policy makers, LCA practitioners and academia as per company's decision to share information as they seem appropriate.

3. Product Description and System Boundaries

3.1 Product Identification and Usage

JSW Steel Limited manufactures the 10 long products across 3 manufacturing plants explained in the Table 5 and Table 6 below. The steel products are produced predominantly by two process routes i.e. Blast Furnace (BF)/Basic Oxygen Furnace (BOF) route and Electric Arc Furnace (EAF) route. JSW Steel has COREX technology for steel production similar to blast furnace technology. Primary data is used for all gate-to-gate processes and iron ore mines owned by JSW Steel. Description of all the products is tabulated below:

Table 5 Specifications of Finished Long Products (Steel)

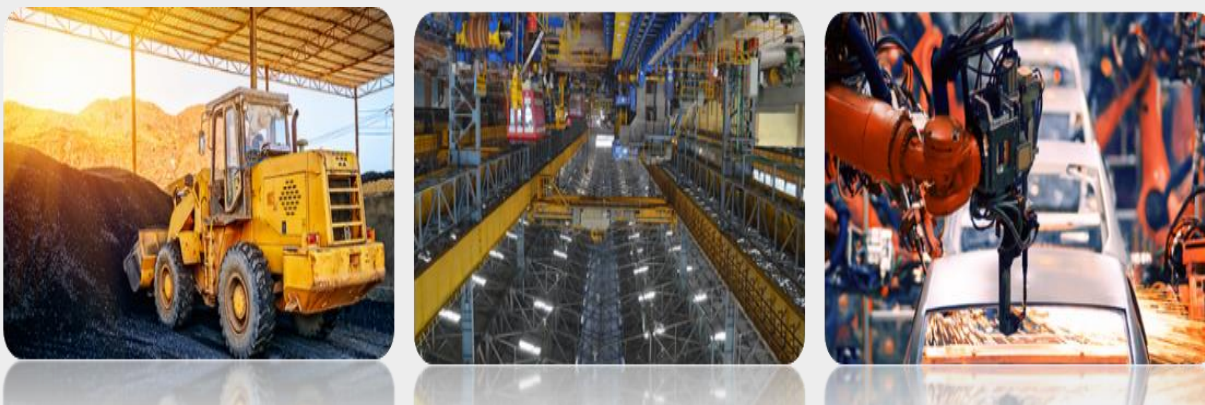
Manufacturing Unit	Product	Diameter	Grades
Vijayanagar	TMT Bar	8 – 40 mm	Fe 500, Fe 500D, Fe 500S, Fe 500D CRS, Fe 550, Fe 550D, Fe 600, Fe 650
	Wire Rod	5.5 – 25 mm	High Carbon Grades, Medium Carbon Grades, Low Carbon Grades, Electrode Grades, CHQ Grades
Dolvi	TMT Bar	8 – 40 mm	Fe 500D, Fe 500D CRS, Fe 550D, Fe 550D CRS, Fe 600, Fe 600 CRS
Salem	Hot Rolled Wire Rod Coil	5.5 – 32 mm	Low Alloy Steel Grades, File Steel Grades, Free Cutting Steel Grades, Spring Steel Grades, Welding Electrode Grades, High Carbon Grades, Cold Heading Quality Grades
	Heat Treated Wire Rod Coil	5.5 – 32 mm	
	Hot Rolled Hexagon Wire Rod Coil	20 - 32 mm	
	Hot Rolled Round Cornered Square (RCS)	55 – 240 mm	Forging Quality Grades, Low Alloy Steel Grades, Micro Alloy Steel Grades, Bearing Steel Grades, Rail Steel Grades, Structural Steel Grades
	Heat Treated Bar	20 - 160 mm	Cold Heading Quality Grades, Forging Quality Grades, Low Alloy Steel Grades, File Steel Grades, Micro Alloy Steel Grades, Free Cutting Steel Grades, Seamless Steel Grades, Rail Steel Grades, Bearing Steel Grades, Structural Steel Grades
	Hot Rolled Bar	20 - 200 mm	
	Hot Rolled Hexagon Bar	20 - 45 mm	

Table 6 Chemical Composition of Finished Long Products (Steel)

Manufacturing Unit	Product	Chemical Composition
Vijayanagar	TMT Bar	<0.32 C%, <0.055 P%, <0.055 S%, 0.42-0.61 CE%
	Wire Rod	0.05-1.10 C%, 0.25-1.50 Mn%, <0.90 Si%, <0.06 P%, <0.06 S%, 0.005-0.040 Al%, 0.10-1.50 Cr%, 0.18-0.22 Mo%
Dolvi	TMT Bar	<0.35 C%, <0.055 P%, <0.055 S%, <0.61% CE
Salem	Hot Rolled Wire Rod Coil	0.08-1.35 C%, 0.20-2.10 Mn%, 0.03-2.10 Si%, <1.11 P%, <0.35 S%, 0.025-2.50 Cr%, 0.02-1.10 Mo% 0.0005-0.005 B%, 0.15-3.75 Ni%, 0.02-0.30 V%, 0.15-0.35 Pb%
	Heat Treated Wire Rod Coil	
	Hot Rolled Hexagon Wire Rod Coil	
	Hot Rolled Round Cornered Square (RCS)	0.10-1.10 C%, 0.30-1.80 Mn%, 0.05-1.00 Si%, <0.06 P%, <0.07 S%, 0.025-2.50 Cr%, <1.10 Mo%, <3.75 Ni%, <0.30 V%, <0.010 Al%
	Heat Treated Bar	0.08-1.35 C%, 0.20-1.80 Mn%, 0.05-2.10 Si%, <0.06 P%, <0.35 S%, 0.025-2.60 Cr%, <1.13 Mo%, <0.30 V%, <0.010 Al%, <0.40 Cu%
	Hot Rolled Bar	
	Hot Rolled Hexagon Bar	



These products are used as raw material in various sectors such as Automobile, Building and construction, mechanical and Electrical equipment, Electrical Appliances, Transport, etc.



These Products do not contain any substance that can be included in “Candidate List of Substances of Very High Concern for Authorization” and raw materials used are not part of EU REACH regulations.

3.2 System boundary

Figure 1 represents system boundary diagram of the study.

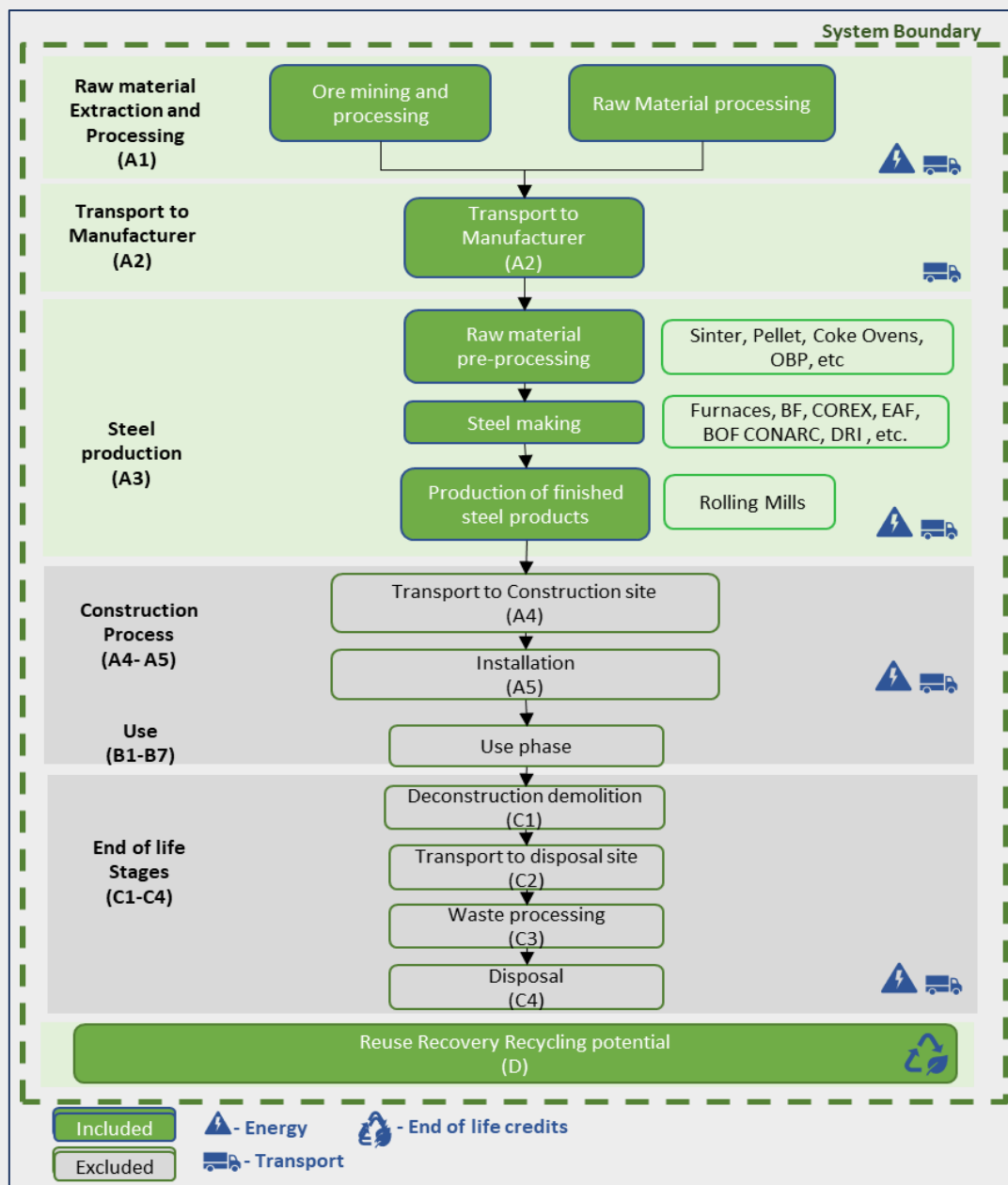


Figure 1 System Boundary Diagram (Cradle to Gate)

3.3 Process Description

Vijayanagar

Products are manufactured using the Blast Furnace with Basic Oxygen Furnace (BF+BOF) route. Iron ore (typical mix based on Ferro-oxides Fe_2O_3), Pellets and other additives are mixed and sintered for being fed into the blast furnace together with coking coke, which is used as the reducing agent. (For COREX the reducing agent is non-coking coal). Also pellets and / or lump may be used.

The hot iron produced in the Blast furnace (BF) & COREX is transferred into the Basic Oxygen Furnace (BOF). In this vessel, the iron is converted into steel by lowering the carbon content of the iron by blowing oxygen into the melt (exothermic reaction). For temperature control, scrap (up to 10%) is

added to the melt. Refining (lowering of sulphur, phosphorous and other tramp elements) and alloying with micro-alloying elements is applied according to steel grade to give the requested characteristics for the steel. Depending on the special requirement for internal soundness.

The production also includes the Electric Arc Furnace (EAF) route. The raw material input consists of Direct Reduced Iron (DRI), Hot metal, Ferro alloys along with allied materials. This raw material is charged to the electric arc furnace. Initially melting takes place by the addition of oxygen and/or fuels. In the oxidation phase, the slag is formed for removal of undesired materials by the addition of lime and coke. In the reduction phase, the slag is reduced for oxygen and sulphur removal.

At the end of the steelmaking process, the liquid steel is transformed into a Wire rod via Wire Rod Mill (WRM) process and into a Bar rod via Bar Rod Mill (BRM) process.

Dolvi

The Dolvi unit features a sponge iron plant, a blast furnace, pellet plant, coke-oven plant, sinter plants, a hot strip mill, an oxygen plant and a lime calcining plant. Conarc process is based on the increased use of hot metal in the electric arc furnace and is aimed at optimizing energy recovery and maximizing productivity in such an operation. The process uses various mix of raw materials like hot metal, Direct Reduced Iron (DRI) and scrap to ensure highest quality requirements for the production of all grades and qualities of steels covering a wide range from carbon steels to stainless steels.

Iron ore fines sintered into porous mass to make them as feed material for blast furnace iron making. The coke breeze generated in coke oven plant and blast furnace is recycled in sinter plant as solid fuel for sintering. The recycled material from gas cleaning plant of blast furnace is also utilized. Flux materials like limestone and dolomite is crushed to <3 mm size in crushing plant and stored in the proportioning bins. Sintering takes place in the machine and the hot sinter is discharged to the circular cooling machine. The cooled sinter is screened to separate the fines. Pellets are fed into DRI and blast furnace along with raw materials (ore, sinter, coke) which are screened before being charged into the blast furnace through conveyors or skip. Air for combustion in the blast furnace is blown from turbo blowers which is preheated in hot blast stoves to temperatures around 1200°C.

The hot iron produced in the Blast Furnace and Direct Reduced Iron (DRI) is transferred into SMS (Steel Melting Shop) and CONARC to produce liquid steel. CONARC process is followed by a ladle furnace to meet the quality requirements. At the end of the steelmaking process, the liquid steel is transformed into a semi-finished product in a continuously casted steel slab and billets. Then billets are sent to BRM for productions of Bar Rods.

Salem

The steel plant follows BF-EOF (Blast Furnace - Energy Optimising Furnace) – SMS (Steel Melting Shop) route. The plant has a two sinter plants, a Non recovery Coke Oven plant, and two blast furnaces supplying hot metal to Energy optimizing furnaces which are connected with continuous casting units to form SMS units. The hot iron produced in the blast furnace and direct reduced iron (DRI) is transferred into SMS Plant to produce liquid steel.

Direct Reduced Iron (DRI) material is brought from Vijayanagar plant through truck transport. At the end of the steelmaking process, the liquid steel is transformed into a semi-finished product in a continuously casted steel slab and billet. The billet is then sent to BRM and Annealing and pickling plant for production of BRM products (Hot Rolled Wore Rod Coil, Hot Rolled Bar, Hot Rolled Hexagon Wire Rod Coil and Hot Rolled Hexagon Bar) and Annealing products (Heat Treated Wire Rod Coil and Heat Treated Bar). The Bloom are sent to Blooming mill for production of Hot Rolled Round Cornered Square (RCS) Bar.

The product is then dispatched and sent for shipping. The process chains are schematically explained in Figure 2 to 4.

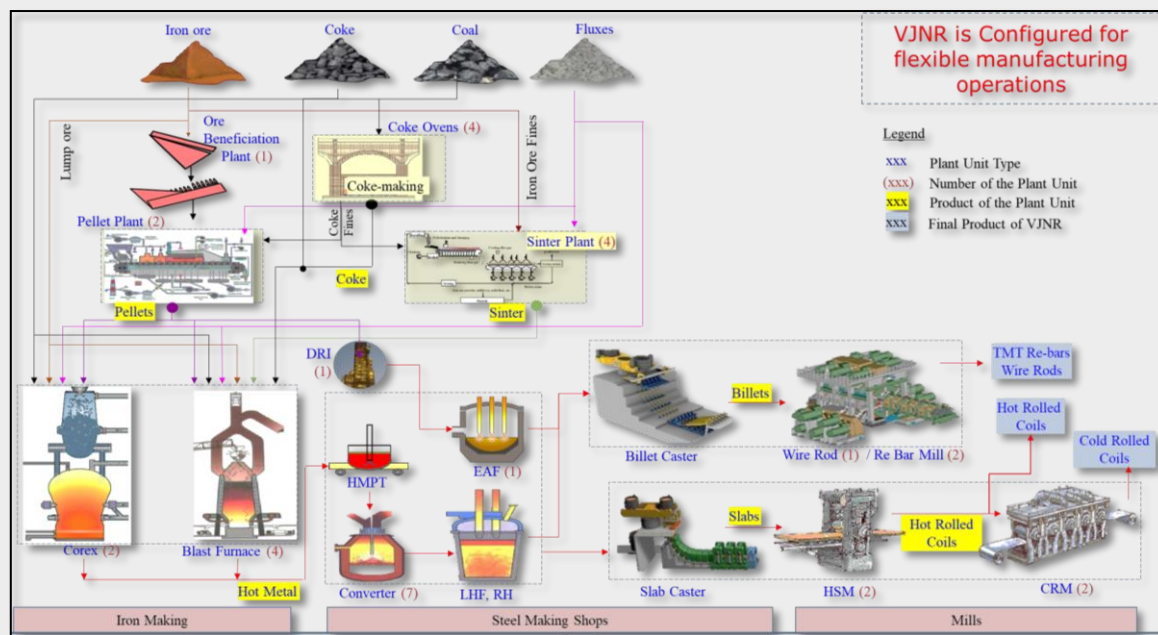


Figure 2 Steel making process at JSW Steel – Vijayanagar

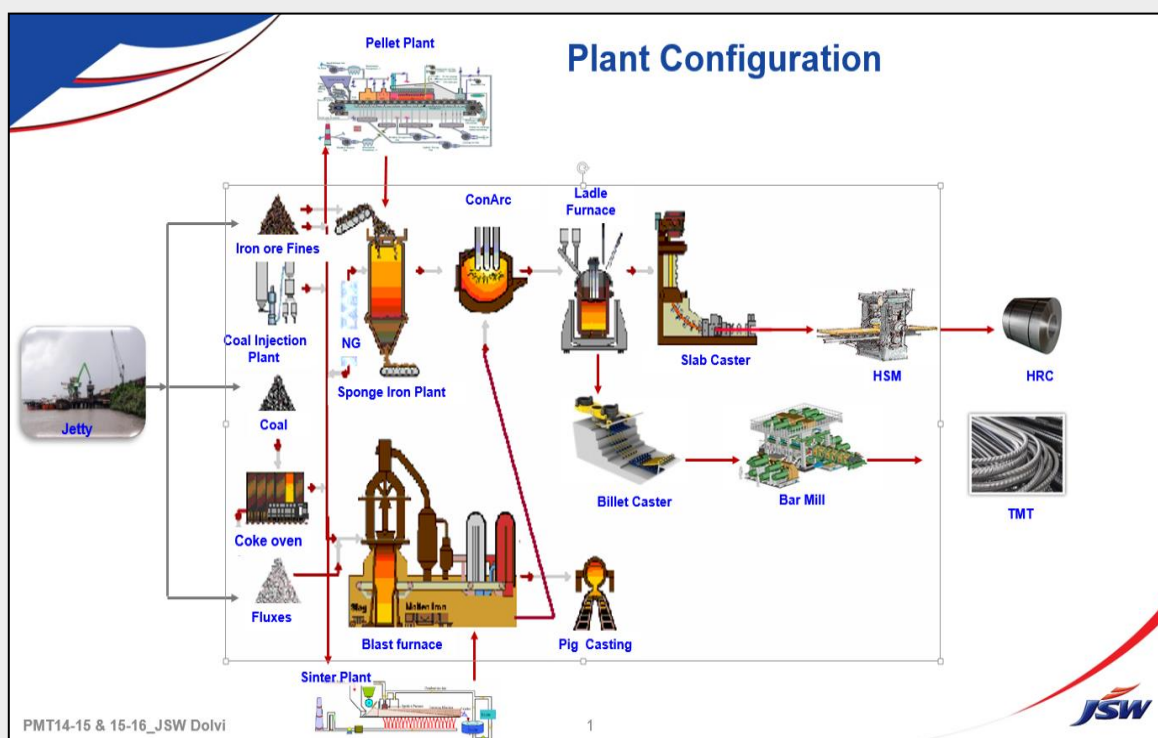


Figure 3 Steel making process at JSW Steel – Dolvi

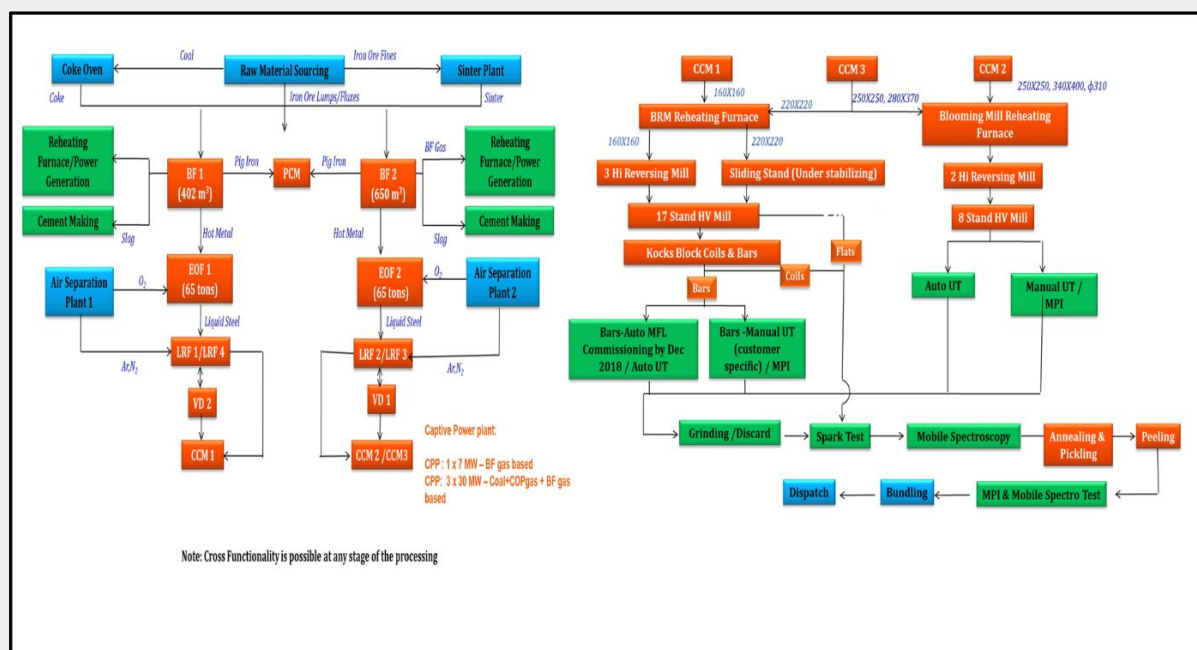


Figure 4 Steel making process at JSW Steel – Salem

Water is used in various processes for cooling as well as process consumption and steam generation in boiler. A contaminated process water flow thus generated is treated together with other waste-water streams. After treatment, the water is recirculated. Additionally, treated sewage water is also consumed which is incorporated in the production process.

4. LCA

4.1 Information Sources and Data Quality

To ensure that JSW can provide the most accurate and representative data for steel products, the quality of the data used in the models must be very high. The quality of the LCI data for modelling the life cycle stages have been assessed according to ISO 14040:2006. Data quality is judged by its precision (measured, calculated or estimated), completeness (e.g. are there unreported emissions?), consistency (degree of uniformity of the methodology applied on an LCA serving as a data source) and representativeness (geographical, time period, technology). Primary data collected using data questionnaires was used for the study and for upstream processes GaBi 10 professional database 2020 was used.

4.2 Methodological Details

4.2.1 Co-Product Allocation

With any multi-product system, allocation rules are defined to relate the system inputs and outputs to each of the products. This is particularly important in the case of the blast furnace route, which generates important quantities of valuable co-products (also known as by-products). Several methods are documented in ISO 14040:2006 and ISO Technical Report 14049. The main co-products for Blast furnace, COREX plants, Coke ovens, BOF and EAF are shown in Below Figure 5.

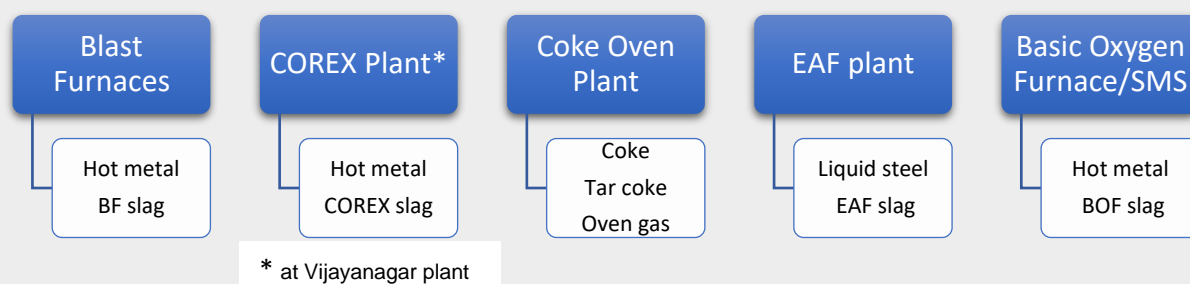


Figure 5 Products in various steel plants where allocation is applied

4.2.2 End-of-life phase

Steel is completely recyclable. Therefore, it is important to consider recycling in LCA studies involving steel, namely the steel scrap that is recycled from a final product at the end of its life. In addition, steel is a vital input to the steelmaking process, and this input of steel scrap should also be considered in LCA studies. This study has considered both the scraps viz, the external scrap used as input in the EAF as well as the End-of-Life scrap generation. Accounting for all these the End-of -life credit for recycling is applied over 85% of steel (850 kg in 1 ton of Steel product) and remaining 15% of steel is considered to be landfilled. The credit includes recycling burden and credit of replacing virgin route steel.

4.2.3 Declared unit

The declared unit for the EPD is 1000 kg (1 tonne) of Average of 10 Finished Long Products of JSW Steel Limited.

4.2.4 Selection of application of LCIA categories

A list of relevant impact categories and category indicators is defined and associated with the inventory data. All environmental impact indicators are evaluated as per EN 15804:2012+A2:2019. These indicators are scientifically and technically valid. The environmental impact per declared unit for the following environmental impact categories were reported in the EPD according with EN 15804+A2 (Shown in below Table 7), and divided into core, upstream (and downstream, if included) module.

Table 7 Environmental impacts indicators

Impact Indicator	Unit
Climate Change	kg CO ₂ eq.
Climate Change (fossil)	kg CO ₂ eq.
Climate Change (biogenic)	kg CO ₂ eq.
Climate Change (luluc)	kg CO ₂ eq.
Ozone depletion	kg CFC-11 eq.
Acidification terrestrial and freshwater	Mole of H ⁺ eq.
Eutrophication freshwater	kg P eq.
Eutrophication marine	kg N eq.
Eutrophication terrestrial	Mole of N eq.
Photochemical ozone formation - human health	kg NMVOC eq.
Resource use, mineral and metals	kg Sb eq.
Resource use, energy carriers	MJ
Water scarcity	m ³ world equiv.

The consumption of natural resources per declared or function unit is reported in the EPD. Input parameters, according with EN 15804+A2, describing resource use are shown in below Table 8.

Table 8 Natural resources use parameters

Parameter	Unit
Renewable primary energy as energy carrier (PERE)	MJ, net calorific value
Renewable primary energy resources as material utilization (PERM)	MJ, net calorific value
Total use of renewable primary energy resources (PERT)	MJ, net calorific value
Non-renewable primary energy as energy carrier (PENRE)	MJ, net calorific value
Non-renewable primary energy as material utilization (PENRM)	MJ, net calorific value
Total use of non-renewable primary energy resources (PENRT)	MJ, net calorific value
Use of secondary material (SM)	kg
Use of renewable secondary fuels (RSF)	MJ
Use of non-renewable secondary fuels (NRSF)	MJ
Net freshwater Use (FW)	m ³

4.3 Cut-off Criteria

Criteria were set out in the original study for the recording of material flows and to avoid the need to pursue trivial inputs/outputs in the system. These are outlined below:

1. All energetic inputs to the process stages were recorded, including heating fuels, electricity, steam and compressed air.
2. The sum of the excluded material flows must not exceed 5% of mass, energy or environmental relevance. However, in reality at least 99.9% of material inputs to each process stage were included.
3. Wastes representing less than 1% of total waste tonnage for given process stages were not recorded unless treated outside of the site.

Criterion 2 was attainable because site input tonnages are weighed by relatively few inputs such as limestone, scrap, metallic additions, refractories, DRI, hot metal, and intermediate steel products which account for >99% of material inputs to each process stage.

4.4 System Boundaries

The study is a cradle-to-grave LCI study with the end-of-life recycling of the steel. That is, it covers all of the production steps from raw materials in the earth (i.e. the cradle) to End of Life Credit (i.e. grave). The cradle-to-grave LCI study, with end-of-life recycling, includes net credits associated with recycling the steel from the final products at the end-of-life (end-of-life scrap). It does not include the manufacture of the downstream final products or their use.

Table 9 Details of system boundary included in the study

EPD Module	Life Cycle Stages	Life Cycle Sub-Stages	Definitions
A1	Materials	Primary raw materials Production	Extraction, production of the raw materials in the upstream.
A2	Upstream Transport	-	Transport of the raw materials to product manufacturing site.
A3	Manufacturing	Iron shops, steel shops and utilities	Manufacturing of various grades of steel products at JSW across the various shops i.e. Blast furnaces, EAF, BOF, SMS, DRI, Sinter plants, Pellet plants, OBP, WRM, BRM, HSM, etc.
C1	Deconstruction / demolition	-	Considered to be zero as applications are varied thus cannot be determined.
C2	Transport to EoL	-	With a collection rate of 100%, the transports are carried out by truck over 50 km
C3	Waste processing for recovery	-	Recycling is already accounted in D stage, so this is considered to be zero.
C4	Disposal	-	Material not getting recycled is considered for landfill. Thus 15% of steel is considered for landfill as 85% is considered for credit.
D	EoL Credit	-	Steel is a 100% recyclable material and as per World Steel Data 85% recoverability is observed. Thus 85% is considered for EoL credit.

4.4.1 Geographic System Boundaries

The geographical coverage of this study covers the production of various grades of steel at JSW, Vijayanagar, Dolvi and Salem. Indian boundaries wherever possible have been adapted and other dataset were chosen from global and European if no Indian datasets were available. In addition, raw materials imported from other geographies are also applied in this study. All the primary data has been collected from JSW in cooperation with experts from Sphera.

4.4.2 Temporal System Boundaries

The data collection is related to one year of operation and the year of the data is indicated in the questionnaire for each data point. The data was derived from the period April 2019 to March 20. The results of the study are relevant for 2021 (the year in which the study is conducted) and are expected to be relevant until such time as there is a significant change in the production mix, energy mix or production technology.

4.4.3 Technology coverage

All models are representative of the technology used at each production site. Primary data is used for all gate-to-gate processes.

- Vijayanagar- Steel is produced predominantly by two process routes: the blast furnace/basic oxygen furnace route and the electric arc furnace route (the BOF and EAF routes respectively). COREX technology is also used for steel production which is modelled similar to Blast furnace system.
- Dolvi - Steel is produced by CONARC process.
- Salem - Steel is produced by BF-EOF- SMS route.

4.5 Software and database

The LCA model was created using the GaBi 10 Software system for life cycle engineering, developed by Sphera Solutions Inc. The GaBi 2020 LCI database provides the life cycle inventory data for several of the raw and process materials obtained from the background system. Detailed database documentation for GaBi datasets can be accessed at <https://www.gabi-software.com/databases/gabi-databases/>.

4.6 Comparability

According to the standards, EPDs do not compare the environmental performance of products in the sector. Any comparison of the declared environmental performance of products lies outside the scope of these standards and is suggested to be feasible only if all compared declarations follow equal standard provisions.

4.7 Results

Modules of the production life cycle included as per PCR is given in Table 10.

Table 10 Modules of the production life cycle included (X=Declared Module; MNA=Module Not Declared)

Production			Installation		Use stage							End-of-Life				Next product system
Raw material supply	Transport to manufacturer	Manufacturing	Transport to building site	Installation into building	Use / application	Maintenance	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	Deconstruction / demolition	Transport to EoL	Waste processing for reuse, recovery, recycle	Disposal	Reuse, recovery or recycling potential
A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
X	X	X	MND	MND	MND	MND	MND	MND	MND	MND	MND	X	X	X	X	X

The results of 1 tonne of Finished Long products (steel) manufactured at JSW Steel - Vijayanagar, Dolvi and Salem plants are given in below Tables.

Vijayanagar

4.7.1. Overall Cradle to Grave LCIA results for 1- tonne TMT Bar

Table 11 Environmental impacts for 1- tonne TMT Bar

Parameter	Unit	A1-A3	C1	C2	C3	C4	D
GWP - total	kg CO ₂ eq.	2.42E+03	0.00E+00	4.13E-03	0.00E+00	2.10E-03	-1.36E+03
GWP - fossil	kg CO ₂ eq.	2.42E+03	0.00E+00	3.96E-03	0.00E+00	2.28E-03	-1.36E+03
GWP - biogenic	kg CO ₂ eq.	6.48E-02	0.00E+00	1.69E-04	0.00E+00	-1.80E-04	5.35E+00
GWP - luluc	kg CO ₂ eq.	3.65E-01	0.00E+00	2.13E-07	0.00E+00	6.55E-06	0.00E+00
ODP	kg CFC-11 eq.	1.60E-06	0.00E+00	2.05E-19	0.00E+00	8.44E-18	3.15E-05
AP	Mole of H ⁺ eq.	2.11E+01	0.00E+00	3.42E-05	0.00E+00	1.63E-05	-2.91E+00
EP - freshwater	kg P eq.	2.50E-04	0.00E+00	8.69E-10	0.00E+00	3.91E-09	5.10E-04
EP - marine	kg N eq.	3.61E+00	0.00E+00	1.59E-05	0.00E+00	4.20E-06	-4.37E-01
EP - terrestrial	Mole of N eq.	3.95E+01	0.00E+00	1.75E-04	0.00E+00	4.62E-05	-5.20E+00
POCP	kg NMVOC eq.	1.03E+01	0.00E+00	3.03E-05	0.00E+00	1.27E-05	-2.32E+00
ADPE	kg Sb eq.	4.55E-05	0.00E+00	4.27E-11	0.00E+00	2.04E-10	-7.06E-04
ADPF	MJ	3.04E+04	0.00E+00	5.49E-02	0.00E+00	2.99E-02	-1.21E+04
WDP	m ³ world equiv.	4.78E+01	0.00E+00	1.27E-05	0.00E+00	2.39E-04	-1.00E+02
Caption	GWP - total = global warming potential; GWP - fossil = global warming potential (fossil fuel only); GWP - biogenic = global warming potential (biogenic); GWP - luluc = global warming potential (land use only); ODP = ozone depletion; AP = acidification terrestrial and freshwater; EP freshwater = eutrophication potential (freshwater); EP - marine = eutrophication potential (marine); EP- terrestrial = eutrophication potential (terrestrial); POCP = photochemical ozone formation; ADPE = abiotic depletion potential (element), ADPF = abiotic depletion potential (fossil) WDP = water scarcity.						

Table 12 Parameters describing resource use for 1-tonne TMT Bar

Parameter	Unit	A1-A3	C1	C2	C3	C4	D
PERE	MJ	2.70E+02	0.00E+00	1.96E-04	0.00E+00	3.91E-03	6.99E+02
PERM	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PERT	MJ	2.70E+02	0.00E+00	1.96E-04	0.00E+00	3.91E-03	6.99E+02
PENRE	MJ	3.04E+04	0.00E+00	5.49E-02	0.00E+00	2.99E-02	-1.21E+04
PENRM	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PENRT	MJ	3.04E+04	0.00E+00	5.49E-02	0.00E+00	2.99E-02	-1.21E+04
SM	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
RSF	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NRSF	MJ	9.29E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
FW	m ³ world equiv.	2.43E+00	0.00E+00	4.36E-07	0.00E+00	7.53E-06	-2.34E+00
Caption	PERE = Use of renewable primary energy excluding the renewable primary energy resource used as raw materials; PERM = Use of renewable primary energy as raw materials; PERT = Total use of renewable primary energy resources; PENRE = Use of non-renewable primary energy excluding the non-renewable primary energy resources used as raw materials; PENRM = Use of non-renewable primary energy used as raw materials; PENRT = Total use of non-renewable primary energy resources; SM = Use of secondary material; RSF = Use of renewable secondary fuels; NRSF = Use of non-renewable secondary fuels; FW = Use of net fresh water						

Table 13 Output flows and waste categories for 1-tonne TMT Bar

Parameter	Unit	A1-A3	C1	C2	C3	C4	D
HWD	kg	1.30E-05	0.00E+00	2.93E-12	0.00E+00	4.55E-10	-1.31E-02
NHWD	kg	1.50E+01	0.00E+00	6.85E-07	0.00E+00	1.50E-01	-1.76E-01
RWD	kg	4.28E-02	0.00E+00	1.14E-08	0.00E+00	3.40E-07	-4.35E-01
MFR	kg	3.29E+02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
MER	kg	-4.05E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
EEF	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
EET	MJ	-3.53E+02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Caption	HWD = Hazardous waste disposed; NHWD = Non-hazardous waste disposed; RWD = Radioactive waste disposed; MFR = Materials for recycling; MER = Materials for energy recovery; EEF = Exported electrical energy; EET = Exported thermal energy						

Table 14 Additional environmental parameters for 1-tonne TMT Bar

Parameter	Unit	A1-A3	C1	C2	C3	C4	D
PM	Disease incidences	4.77E-04	0.00E+00	2.22E-10	0.00E+00	2.02E-10	-1.85E-05
IR	kBq U235 eq.	4.33E+00	0.00E+00	1.08E-06	0.00E+00	3.50E-05	8.26E+00
ETF-fw	CTUe	3.50E+03	0.00E+00	1.89E-02	0.00E+00	1.71E-02	-6.17E+03
HTP-c	CTUh	2.18E-07	0.00E+00	3.24E-13	0.00E+00	2.53E-12	3.43E-07
HTP-nc	CTUh	1.63E-05	0.00E+00	1.54E-11	0.00E+00	2.78E-10	-2.28E-05
SQP	Pt	5.33E+02	0.00E+00	2.37E-04	0.00E+00	6.22E-03	7.13E-03
Caption	PM = Particulate matter emissions; IR = Ionising radiation, human health; ETF= Eco-toxicity (freshwater); HTP-c = Human toxicity, cancer effects; HTP-nc = Human toxicity, non-cancer effects; SQP = Soil quality potential/Land use related impacts						

4.7.2. Overall Cradle to Grave LCIA results for 1- tonne Wire Rod**Table 15 Environmental impacts for 1- tonne Wire Rod**

Parameter	Unit	A1-A3	C1	C2	C3	C4	D
GWP - total	kg CO ₂ eq.	2.59E+03	0.00E+00	4.13E-03	0.00E+00	2.10E-03	-1.36E+03
GWP - fossil	kg CO ₂ eq.	2.59E+03	0.00E+00	3.96E-03	0.00E+00	2.28E-03	-1.36E+03
GWP - biogenic	kg CO ₂ eq.	5.21E-02	0.00E+00	1.69E-04	0.00E+00	-1.80E-04	5.35E+00
GWP - luluc	kg CO ₂ eq.	3.81E-01	0.00E+00	2.13E-07	0.00E+00	6.55E-06	0.00E+00
ODP	kg CFC-11 eq.	1.60E-06	0.00E+00	2.05E-19	0.00E+00	8.44E-18	3.15E-05
AP	Mole of H ⁺ eq.	2.21E+01	0.00E+00	3.42E-05	0.00E+00	1.63E-05	-2.91E+00
EP - freshwater	kg P eq.	2.57E-04	0.00E+00	8.69E-10	0.00E+00	3.91E-09	5.10E-04
EP - marine	kg N eq.	3.76E+00	0.00E+00	1.59E-05	0.00E+00	4.20E-06	-4.37E-01
EP - terrestrial	Mole of N eq.	4.12E+01	0.00E+00	1.75E-04	0.00E+00	4.62E-05	-5.20E+00
POCP	kg NMVOC eq.	1.08E+01	0.00E+00	3.03E-05	0.00E+00	1.27E-05	-2.32E+00
ADPE	kg Sb eq.	4.59E-05	0.00E+00	4.27E-11	0.00E+00	2.04E-10	-7.06E-04
ADPF	MJ	3.12E+04	0.00E+00	5.49E-02	0.00E+00	2.99E-02	-1.21E+04
WDP	m ³ world equiv.	5.37E+01	0.00E+00	1.27E-05	0.00E+00	2.39E-04	-1.00E+02
Caption	GWP - total = global warming potential; GWP - fossil = global warming potential (fossil fuel only); GWP - biogenic = global warming potential (biogenic); GWP - luluc = global warming potential (land use only); ODP = ozone depletion; AP = acidification terrestrial and freshwater; EP freshwater = eutrophication potential (freshwater); EP - marine = eutrophication potential (marine); EP- terrestrial = eutrophication potential (terrestrial); POCP = photochemical ozone formation; ADPE = abiotic depletion potential (element), ADPF = abiotic depletion potential (fossil) WDP = water scarcity.						

Table 16 Parameters describing resource use for 1-tonne Wire Rod

Parameter	Unit	A1-A3	C1	C2	C3	C4	D
PERE	MJ	2.77E+02	0.00E+00	1.96E-04	0.00E+00	3.91E-03	6.99E+02
PERM	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PERT	MJ	2.77E+02	0.00E+00	1.96E-04	0.00E+00	3.91E-03	6.99E+02
PENRE	MJ	3.12E+04	0.00E+00	5.49E-02	0.00E+00	2.99E-02	-1.21E+04
PENRM	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PENRT	MJ	3.12E+04	0.00E+00	5.49E-02	0.00E+00	2.99E-02	-1.21E+04
SM	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
RSF	MJ	6.12E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NRSF	MJ	9.31E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
FW	m ³ world equiv.	2.58E+00	0.00E+00	4.36E-07	0.00E+00	7.53E-06	-2.34E+00
Caption	PERE = Use of renewable primary energy excluding the renewable primary energy resource used as raw materials; PERM = Use of renewable primary energy as raw materials; PERT = Total use of renewable primary energy resources; PENRE = Use of non-renewable primary energy excluding the non-renewable primary energy resources used as raw materials; PENRM = Use of non-renewable primary energy used as raw materials; PENRT = Total use of non-renewable primary energy resources; SM = Use of secondary material; RSF = Use of renewable secondary fuels; NRSF = Use of non-renewable secondary fuels; FW = Use of net fresh water						

Table 17 Output flows and waste categories for 1-tonne Wire Rod

Parameter	Unit	A1-A3	C1	C2	C3	C4	D
HWD	kg	1.35E-05	0.00E+00	2.93E-12	0.00E+00	4.55E-10	-1.31E-02
NHWD	kg	1.57E+01	0.00E+00	6.85E-07	0.00E+00	1.50E-01	-1.76E-01
RWD	kg	4.34E-02	0.00E+00	1.14E-08	0.00E+00	3.40E-07	-4.35E-01
MFR	kg	3.30E+02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
MER	kg	-4.15E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
EEF	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
EET	MJ	-3.53E+02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Caption	HWD = Hazardous waste disposed; NHWD = Non-hazardous waste disposed; RWD = Radioactive waste disposed; MFR = Materials for recycling; MER = Materials for energy recovery; EEF = Exported electrical energy; EET = Exported thermal energy						

Table 18 Additional environmental parameters for 1-tonne Wire Rod

Parameter	Unit	A1-A3	C1	C2	C3	C4	D
PM	Disease incidences	4.98E-04	0.00E+00	2.22E-10	0.00E+00	2.02E-10	-1.85E-05
IR	kBq U235 eq.	4.40E+00	0.00E+00	1.08E-06	0.00E+00	3.50E-05	8.26E+00
ETF-fw	CTUe	3.58E+03	0.00E+00	1.89E-02	0.00E+00	1.71E-02	-6.17E+03
HTP-c	CTUh	2.27E-07	0.00E+00	3.24E-13	0.00E+00	2.53E-12	3.43E-07
HTP-nc	CTUh	1.69E-05	0.00E+00	1.54E-11	0.00E+00	2.78E-10	-2.28E-05
SQP	Pt	5.53E+02	0.00E+00	2.37E-04	0.00E+00	6.22E-03	7.13E-03
Caption	PM = Particulate matter emissions; IR = Ionising radiation, human health; ETF= Eco-toxicity (freshwater); HTP-c = Human toxicity, cancer effects; HTP-nc = Human toxicity, non-cancer effects; SQP = Soil quality potential/Land use related impacts						

Dolvi

4.7.3. Overall Cradle to Grave LCIA results for 1- tonne TMT Bar

Table 19 Environmental impacts for 1- tonne TMT Bar

Parameter	Unit	A1-A3	C1	C2	C3	C4	D
GWP - total	kg CO ₂ eq.	3.25E+03	0.00E+00	4.13E-03	0.00E+00	2.10E-03	-1.36E+03
GWP - fossil	kg CO ₂ eq.	3.24E+03	0.00E+00	3.96E-03	0.00E+00	2.28E-03	-1.36E+03
GWP - biogenic	kg CO ₂ eq.	9.05E-01	0.00E+00	1.69E-04	0.00E+00	-1.80E-04	5.35E+00
GWP - luluc	kg CO ₂ eq.	8.18E-01	0.00E+00	2.13E-07	0.00E+00	6.55E-06	0.00E+00
ODP	kg CFC-11 eq.	1.74E-06	0.00E+00	2.05E-19	0.00E+00	8.44E-18	3.15E-05
AP	Mole of H ⁺ eq.	2.67E+01	0.00E+00	3.42E-05	0.00E+00	1.63E-05	-2.91E+00
EP - freshwater	kg P eq.	5.07E-04	0.00E+00	8.69E-10	0.00E+00	3.91E-09	5.10E-04
EP - marine	kg N eq.	4.00E+00	0.00E+00	1.59E-05	0.00E+00	4.20E-06	-4.37E-01
EP - terrestrial	Mole of N eq.	4.39E+01	0.00E+00	1.75E-04	0.00E+00	4.62E-05	-5.20E+00
POCP	kg NMVOC eq.	1.17E+01	0.00E+00	3.03E-05	0.00E+00	1.27E-05	-2.32E+00
ADPE	kg Sb eq.	1.25E-04	0.00E+00	4.27E-11	0.00E+00	2.04E-10	-7.06E-04
ADPF	MJ	2.74E+04	0.00E+00	5.49E-02	0.00E+00	2.99E-02	-1.21E+04
WDP	m ³ world equiv.	2.71E+02	0.00E+00	1.27E-05	0.00E+00	2.39E-04	-1.00E+02
Caption	GWP - total = global warming potential; GWP - fossil = global warming potential (fossil fuel only); GWP - biogenic = global warming potential (biogenic); GWP - luluc = global warming potential (land use only); ODP = ozone depletion; AP = acidification terrestrial and freshwater; EP freshwater = eutrophication potential (freshwater); EP - marine = eutrophication potential (marine); EP- terrestrial = eutrophication potential (terrestrial); POCP = photochemical ozone formation; ADPE = abiotic depletion potential (element), ADPF = abiotic depletion potential (fossil) WDP = water scarcity.						

Table 20 Parameters describing resource use for 1-tonne TMT Bar

Parameter	Unit	A1-A3	C1	C2	C3	C4	D
PERE	MJ	8.44E+02	0.00E+00	1.96E-04	0.00E+00	3.91E-03	6.99E+02
PERM	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PERT	MJ	8.44E+02	0.00E+00	1.96E-04	0.00E+00	3.91E-03	6.99E+02
PENRE	MJ	2.74E+04	0.00E+00	5.49E-02	0.00E+00	2.99E-02	-1.21E+04
PENRM	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PENRT	MJ	2.74E+04	0.00E+00	5.49E-02	0.00E+00	2.99E-02	-1.21E+04
SM	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
RSF	MJ	6.54E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NRSF	MJ	9.96E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
FW	m ³ world equiv.	6.35E+00	0.00E+00	4.36E-07	0.00E+00	7.53E-06	-2.34E+00
Caption	PERE = Use of renewable primary energy excluding the renewable primary energy resource used as raw materials; PERM = Use of renewable primary energy as raw materials; PERT = Total use of renewable primary energy resources; PENRE = Use of non-renewable primary energy excluding the non-renewable primary energy resources used as raw materials; PENRM = Use of non-renewable primary energy used as raw materials; PENRT = Total use of non-renewable primary energy resources; SM = Use of secondary material; RSF = Use of renewable secondary fuels; NRSF = Use of non-renewable secondary fuels; FW = Use of net fresh water						

Table 21 Output flows and waste categories for 1-tonne TMT Bar

Parameter	Unit	A1-A3	C1	C2	C3	C4	D
HWD	kg	2.84E-05	0.00E+00	2.93E-12	0.00E+00	4.55E-10	-1.31E-02
NHWD	kg	1.69E+01	0.00E+00	6.85E-07	0.00E+00	1.50E-01	-1.76E-01
RWD	kg	1.06E-01	0.00E+00	1.14E-08	0.00E+00	3.40E-07	-4.35E-01
MFR	kg	3.83E+02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
MER	kg	-2.06E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
EEF	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
EET	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Caption	HWD = Hazardous waste disposed; NHWD = Non-hazardous waste disposed; RWD = Radioactive waste disposed; MFR = Materials for recycling; MER = Materials for energy recovery; EEF = Exported electrical energy; EET = Exported thermal energy						

Table 22 Additional environmental parameters for 1-tonne TMT Bar

Parameter	Unit	A1-A3	C1	C2	C3	C4	D
PM	Disease incidences	9.14E-04	0.00E+00	2.22E-10	0.00E+00	2.02E-10	-1.85E-05
IR	kBq U235 eq.	1.04E+01	0.00E+00	1.08E-06	0.00E+00	3.50E-05	8.26E+00
ETF-fw	CTUe	3.05E+03	0.00E+00	1.89E-02	0.00E+00	1.71E-02	-6.17E+03
HTP-c	CTUh	3.01E-07	0.00E+00	3.24E-13	0.00E+00	2.53E-12	3.43E-07
HTP-nc	CTUh	1.96E-05	0.00E+00	1.54E-11	0.00E+00	2.78E-10	-2.28E-05
SQP	Pt	1.69E+03	0.00E+00	2.37E-04	0.00E+00	6.22E-03	7.13E-03
Caption	PM = Particulate matter emissions; IR = Ionising radiation, human health; ETF= Eco-toxicity (freshwater); HTP-c = Human toxicity, cancer effects; HTP-nc = Human toxicity, non-cancer effects; SQP = Soil quality potential/Land use related impacts						

Salem

4.7.4. Overall Cradle to Grave LCIA results for 1- tonne Hot Rolled Bar

Table 23 Environmental impacts for 1-tonne Hot Rolled Bar

Parameter	Unit	A1-A3	C1	C2	C3	C4	D
GWP - total	kg CO ₂ eq.	2.87E+03	0.00E+00	4.13E-03	0.00E+00	2.10E-03	-1.36E+03
GWP - fossil	kg CO ₂ eq.	2.91E+03	0.00E+00	3.96E-03	0.00E+00	2.28E-03	-1.36E+03
GWP - biogenic	kg CO ₂ eq.	3.60E+01	0.00E+00	1.69E-04	0.00E+00	-1.80E-04	5.35E+00
GWP - luluc	kg CO ₂ eq.	5.33E-01	0.00E+00	2.13E-07	0.00E+00	6.55E-06	0.00E+00
ODP	kg CFC-11 eq.	5.67E-06	0.00E+00	2.05E-19	0.00E+00	8.44E-18	3.15E-05
AP	Mole of H ⁺ eq.	2.56E+01	0.00E+00	3.42E-05	0.00E+00	1.63E-05	-2.91E+00
EP - freshwater	kg P eq.	2.85E-04	0.00E+00	8.69E-10	0.00E+00	3.91E-09	5.10E-04
EP - marine	kg N eq.	4.10E+00	0.00E+00	1.59E-05	0.00E+00	4.20E-06	-4.37E-01
EP - terrestrial	Mole of N eq.	4.49E+01	0.00E+00	1.75E-04	0.00E+00	4.62E-05	-5.20E+00
POCP	kg NMVOC eq.	1.19E+01	0.00E+00	3.03E-05	0.00E+00	1.27E-05	-2.32E+00
ADPE	kg Sb eq.	1.45E-05	0.00E+00	4.27E-11	0.00E+00	2.04E-10	-7.06E-04
ADPF	MJ	3.42E+04	0.00E+00	5.49E-02	0.00E+00	2.99E-02	-1.21E+04
WDP	m ³ world equiv.	1.14E+02	0.00E+00	1.27E-05	0.00E+00	2.39E-04	-1.00E+02
Caption	GWP - total = global warming potential; GWP - fossil = global warming potential (fossil fuel only); GWP - biogenic = global warming potential (biogenic); GWP - luluc = global warming potential (land use only); ODP = ozone depletion; AP = acidification terrestrial and freshwater; EP freshwater = eutrophication potential (freshwater); EP - marine = eutrophication potential (marine); EP- terrestrial = eutrophication potential (terrestrial); POCP = photochemical ozone formation; ADPE = abiotic depletion potential (element), ADPF = abiotic depletion potential (fossil) WDP = water scarcity.						

Table 24 Parameters describing resource use for 1-tonne Hot Rolled Bar

Parameter	Unit	A1-A3	C1	C2	C3	C4	D
PERE	MJ	8.92E+02	0.00E+00	1.96E-04	0.00E+00	3.91E-03	6.99E+02
PERM	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PERT	MJ	8.92E+02	0.00E+00	1.96E-04	0.00E+00	3.91E-03	6.99E+02
PENRE	MJ	3.42E+04	0.00E+00	5.49E-02	0.00E+00	2.99E-02	-1.21E+04
PENRM	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PENRT	MJ	3.42E+04	0.00E+00	5.49E-02	0.00E+00	2.99E-02	-1.21E+04
SM	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
RSF	MJ	2.90E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NRSF	MJ	4.40E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
FW	m ³ world equiv.	2.96E+00	0.00E+00	4.36E-07	0.00E+00	7.53E-06	-2.34E+00
Caption	PERE = Use of renewable primary energy excluding the renewable primary energy resource used as raw materials; PERM = Use of renewable primary energy as raw materials; PERT = Total use of renewable primary energy resources; PENRE = Use of non-renewable primary energy excluding the non-renewable primary energy resources used as raw materials; PENRM = Use of non-renewable primary energy used as raw materials; PENRT = Total use of non-renewable primary energy resources; SM = Use of secondary material; RSF = Use of renewable secondary fuels; NRSF = Use of non-renewable secondary fuels; FW = Use of net fresh water						

Table 25 Output flows and waste categories for 1-tonne Hot Rolled Bar

Parameter	Unit	A1-A3	C1	C2	C3	C4	D
HWD	kg	1.55E-05	0.00E+00	2.93E-12	0.00E+00	4.55E-10	-1.31E-02
NHWD	kg	1.72E+01	0.00E+00	6.85E-07	0.00E+00	1.50E-01	-1.76E-01
RWD	kg	1.16E-01	0.00E+00	1.14E-08	0.00E+00	3.40E-07	-4.35E-01
MFR	kg	5.49E+02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
MER	kg	7.98E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
EEF	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
EET	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Caption	HWD = Hazardous waste disposed; NHWD = Non-hazardous waste disposed; RWD = Radioactive waste disposed; MFR = Materials for recycling; MER = Materials for energy recovery; EEF = Exported electrical energy; EET = Exported thermal energy						

Table 26 Additional environmental parameters for 1-tonne Hot Rolled Bar

Parameter	Unit	A1-A3	C1	C2	C3	C4	D
PM	Disease incidences	5.78E-04	0.00E+00	2.22E-10	0.00E+00	2.02E-10	-1.85E-05
IR	kBq U235 eq.	1.18E+01	0.00E+00	1.08E-06	0.00E+00	3.50E-05	8.26E+00
ETF-fw	CTUe	5.02E+03	0.00E+00	1.89E-02	0.00E+00	1.71E-02	-6.17E+03
HTP-c	CTUh	3.05E-07	0.00E+00	3.24E-13	0.00E+00	2.53E-12	3.43E-07
HTP-nc	CTUh	2.92E-05	0.00E+00	1.54E-11	0.00E+00	2.78E-10	-2.28E-05
SQP	Pt	6.74E+02	0.00E+00	2.37E-04	0.00E+00	6.22E-03	7.13E-03
Caption	PM = Particulate matter emissions; IR = Ionising radiation, human health; ETF= Eco-toxicity (freshwater); HTP-c = Human toxicity, cancer effects; HTP-nc = Human toxicity, non-cancer effects; SQP = Soil quality potential/Land use related impacts						

4.7.5. Overall Cradle to Grave LCIA results for 1- tonne Hot Rolled Wire Rod Coil

Table 27 Environmental impacts for 1-tonne Hot Rolled Wire Rod Coil

Parameter	Unit	A1-A3	C1	C2	C3	C4	D
GWP - total	kg CO ₂ eq.	2.87E+03	0.00E+00	4.13E-03	0.00E+00	2.10E-03	-1.36E+03
GWP - fossil	kg CO ₂ eq.	2.91E+03	0.00E+00	3.96E-03	0.00E+00	2.28E-03	-1.36E+03
GWP - biogenic	kg CO ₂ eq.	-3.60E+01	0.00E+00	1.69E-04	0.00E+00	-1.80E-04	5.35E+00
GWP - luluc	kg CO ₂ eq.	5.33E-01	0.00E+00	2.13E-07	0.00E+00	6.55E-06	0.00E+00
ODP	kg CFC-11 eq.	5.67E-06	0.00E+00	2.05E-19	0.00E+00	8.44E-18	3.15E-05
AP	Mole of H ⁺ eq.	2.56E+01	0.00E+00	3.42E-05	0.00E+00	1.63E-05	-2.91E+00
EP - freshwater	kg P eq.	2.85E-04	0.00E+00	8.69E-10	0.00E+00	3.91E-09	5.10E-04
EP - marine	kg N eq.	4.10E+00	0.00E+00	1.59E-05	0.00E+00	4.20E-06	-4.37E-01
EP - terrestrial	Mole of N eq.	4.49E+01	0.00E+00	1.75E-04	0.00E+00	4.62E-05	-5.20E+00
POCP	kg NMVOC eq.	1.19E+01	0.00E+00	3.03E-05	0.00E+00	1.27E-05	-2.32E+00
ADPE	kg Sb eq.	1.45E-05	0.00E+00	4.27E-11	0.00E+00	2.04E-10	-7.06E-04
ADPF	MJ	3.42E+04	0.00E+00	5.49E-02	0.00E+00	2.99E-02	-1.21E+04
WDP	m ³ world equiv.	1.14E+02	0.00E+00	1.27E-05	0.00E+00	2.39E-04	-1.00E+02
Caption	GWP - total = global warming potential; GWP - fossil = global warming potential (fossil fuel only); GWP - biogenic = global warming potential (biogenic); GWP - luluc = global warming potential (land use only); ODP = ozone depletion; AP = acidification terrestrial and freshwater; EP freshwater = eutrophication potential (freshwater); EP - marine = eutrophication potential (marine); EP- terrestic = eutrophication potential (terrestrial); POCP = photochemical ozone formation; ADPE = abiotic depletion potential (element), ADPF = abiotic depletion potential (fossil) WDP = water scarcity.						

Table 28 Parameters describing resource use for 1-tonne Hot Rolled Wire Rod Coil

Parameter	Unit	A1-A3	C1	C2	C3	C4	D
PERE	MJ	8.92E+02	0.00E+00	1.96E-04	0.00E+00	3.91E-03	6.99E+02
PERM	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PERT	MJ	8.92E+02	0.00E+00	1.96E-04	0.00E+00	3.91E-03	6.99E+02
PENRE	MJ	3.42E+04	0.00E+00	5.49E-02	0.00E+00	2.99E-02	-1.21E+04
PENRM	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PENRT	MJ	3.42E+04	0.00E+00	5.49E-02	0.00E+00	2.99E-02	-1.21E+04
SM	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
RSF	MJ	2.90E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NRSF	MJ	4.40E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
FW	m ³ world equiv.	2.96E+00	0.00E+00	4.36E-07	0.00E+00	7.53E-06	-2.34E+00
Caption	PERE = Use of renewable primary energy excluding the renewable primary energy resource used as raw materials; PERM = Use of renewable primary energy as raw materials; PERT = Total use of renewable primary energy resources; PENRE = Use of non-renewable primary energy excluding the non-renewable primary energy resources used as raw materials; PENRM = Use of non-renewable primary energy used as raw materials; PENRT = Total use of non-renewable primary energy resources; SM = Use of secondary material; RSF = Use of renewable secondary fuels; NRSF = Use of non-renewable secondary fuels; FW = Use of net fresh water						

Table 29 Output flows and waste categories for 1-tonne Hot Rolled Wire Rod Coil

Parameter	Unit	A1-A3	C1	C2	C3	C4	D
HWD	kg	1.55E-05	0.00E+00	2.93E-12	0.00E+00	4.55E-10	-1.31E-02
NHWD	kg	1.72E+01	0.00E+00	6.85E-07	0.00E+00	1.50E-01	-1.76E-01
RWD	kg	1.16E-01	0.00E+00	1.14E-08	0.00E+00	3.40E-07	-4.35E-01
MFR	kg	5.49E+02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
MER	kg	7.98E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
EEF	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
EET	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Caption	HWD = Hazardous waste disposed; NHWD = Non-hazardous waste disposed; RWD = Radioactive waste disposed; MFR = Materials for recycling; MER = Materials for energy recovery; EEF = Exported electrical energy; EET = Exported thermal energy						

Table 30 Additional environmental parameters for 1-tonne Hot Rolled Wire Rod Coil

Parameter	Unit	A1-A3	C1	C2	C3	C4	D
PM	Disease incidences	5.78E-04	0.00E+00	2.22E-10	0.00E+00	2.02E-10	-1.85E-05
IR	kBq U235 eq.	1.18E+01	0.00E+00	1.08E-06	0.00E+00	3.50E-05	8.26E+00
ETF-fw	CTUe	5.02E+03	0.00E+00	1.89E-02	0.00E+00	1.71E-02	-6.17E+03
HTP-c	CTUh	3.05E-07	0.00E+00	3.24E-13	0.00E+00	2.53E-12	3.43E-07
HTP-nc	CTUh	2.92E-05	0.00E+00	1.54E-11	0.00E+00	2.78E-10	-2.28E-05
SQP	Pt	6.74E+02	0.00E+00	2.37E-04	0.00E+00	6.22E-03	7.13E-03
Caption	PM = Particulate matter emissions; IR = Ionising radiation, human health; ETF= Eco-toxicity (freshwater); HTP-c = Human toxicity, cancer effects; HTP-nc = Human toxicity, non-cancer effects; SQP = Soil quality potential/Land use related impacts						

4.7.6. Overall Cradle to Grave LCIA results for 1- tonne Hot Rolled Hexagon Bar**Table 31 Environmental impacts for 1-tonne Hot Rolled Hexagon Bar**

Parameter	Unit	A1-A3	C1	C2	C3	C4	D
GWP - total	kg CO ₂ eq.	2.87E+03	0.00E+00	4.13E-03	0.00E+00	2.10E-03	-1.36E+03
GWP - fossil	kg CO ₂ eq.	2.91E+03	0.00E+00	3.96E-03	0.00E+00	2.28E-03	-1.36E+03
GWP - biogenic	kg CO ₂ eq.	-3.60E+01	0.00E+00	1.69E-04	0.00E+00	-1.80E-04	5.35E+00
GWP - luluc	kg CO ₂ eq.	5.33E-01	0.00E+00	2.13E-07	0.00E+00	6.55E-06	0.00E+00
ODP	kg CFC-11 eq.	5.67E-06	0.00E+00	2.05E-19	0.00E+00	8.44E-18	3.15E-05
AP	Mole of H ⁺ eq.	2.56E+01	0.00E+00	3.42E-05	0.00E+00	1.63E-05	-2.91E+00
EP - freshwater	kg P eq.	2.85E-04	0.00E+00	8.69E-10	0.00E+00	3.91E-09	5.10E-04
EP - marine	kg N eq.	4.10E+00	0.00E+00	1.59E-05	0.00E+00	4.20E-06	-4.37E-01
EP - terrestrial	Mole of N eq.	4.49E+01	0.00E+00	1.75E-04	0.00E+00	4.62E-05	-5.20E+00
POCP	kg NMVOC eq.	1.19E+01	0.00E+00	3.03E-05	0.00E+00	1.27E-05	-2.32E+00
ADPE	kg Sb eq.	1.45E-05	0.00E+00	4.27E-11	0.00E+00	2.04E-10	-7.06E-04
ADPF	MJ	3.42E+04	0.00E+00	5.49E-02	0.00E+00	2.99E-02	-1.21E+04
WDP	m ³ world equiv.	1.14E+02	0.00E+00	1.27E-05	0.00E+00	2.39E-04	-1.00E+02
Caption	GWP - total = global warming potential; GWP - fossil = global warming potential (fossil fuel only); GWP - biogenic = global warming potential (biogenic); GWP - luluc = global warming potential (land use only); ODP = ozone depletion; AP = acidification terrestrial and freshwater; EP freshwater = eutrophication potential (freshwater); EP - marine = eutrophication potential (marine); EP- terrestrial = eutrophication potential (terrestrial); POCP = photochemical ozone formation; ADPE = abiotic depletion potential (element), ADPF = abiotic depletion potential (fossil) WDP = water scarcity.						

Table 32 Parameters describing resource use for 1-tonne Hot Rolled Hexagon Bar

Parameter	Unit	A1-A3	C1	C2	C3	C4	D
PERE	MJ	8.92E+02	0.00E+00	1.96E-04	0.00E+00	3.91E-03	6.99E+02
PERM	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PERT	MJ	8.92E+02	0.00E+00	1.96E-04	0.00E+00	3.91E-03	6.99E+02
PENRE	MJ	3.42E+04	0.00E+00	5.49E-02	0.00E+00	2.99E-02	-1.21E+04
PENRM	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PENRT	MJ	3.42E+04	0.00E+00	5.49E-02	0.00E+00	2.99E-02	-1.21E+04
SM	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
RSF	MJ	2.90E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NRSF	MJ	4.40E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
FW	m ³ world equiv.	2.96E+00	0.00E+00	4.36E-07	0.00E+00	7.53E-06	-2.34E+00
Caption	PERE = Use of renewable primary energy excluding the renewable primary energy resource used as raw materials; PERM = Use of renewable primary energy as raw materials; PERT = Total use of renewable primary energy resources; PENRE = Use of non-renewable primary energy excluding the non-renewable primary energy resources used as raw materials; PENRM = Use of non-renewable primary energy used as raw materials; PENRT = Total use of non-renewable primary energy resources; SM = Use of secondary material; RSF = Use of renewable secondary fuels; NRSF = Use of non-renewable secondary fuels; FW = Use of net fresh water						

Table 33 Output flows and waste categories for 1-tonne Hot Rolled Hexagon Bar

Parameter	Unit	A1-A3	C1	C2	C3	C4	D
HWD	kg	1.55E-05	0.00E+00	2.93E-12	0.00E+00	4.55E-10	-1.31E-02
NHWD	kg	1.72E+01	0.00E+00	6.85E-07	0.00E+00	1.50E-01	-1.76E-01
RWD	kg	1.16E-01	0.00E+00	1.14E-08	0.00E+00	3.40E-07	-4.35E-01
MFR	kg	5.49E+02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
MER	kg	7.98E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
EEF	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
EET	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Caption	HWD = Hazardous waste disposed; NHWD = Non-hazardous waste disposed; RWD = Radioactive waste disposed; MFR = Materials for recycling; MER = Materials for energy recovery; EEF = Exported electrical energy; EET = Exported thermal energy						

Table 34 Additional environmental parameters for 1-tonne Hot Rolled Hexagon Bar

Parameter	Unit	A1-A3	C1	C2	C3	C4	D
PM	Disease incidences	5.78E-04	0.00E+00	2.22E-10	0.00E+00	2.02E-10	-1.85E-05
IR	kBq U235 eq.	1.18E+01	0.00E+00	1.08E-06	0.00E+00	3.50E-05	8.26E+00
ETF-fw	CTUe	5.02E+03	0.00E+00	1.89E-02	0.00E+00	1.71E-02	-6.17E+03
HTP-c	CTUh	3.05E-07	0.00E+00	3.24E-13	0.00E+00	2.53E-12	3.43E-07
HTP-nc	CTUh	2.92E-05	0.00E+00	1.54E-11	0.00E+00	2.78E-10	-2.28E-05
SQP	Pt	6.74E+02	0.00E+00	2.37E-04	0.00E+00	6.22E-03	7.13E-03
Caption	PM = Particulate matter emissions; IR = Ionising radiation, human health; ETF= Eco-toxicity (freshwater); HTP-c = Human toxicity, cancer effects; HTP-nc = Human toxicity, non-cancer effects; SQP = Soil quality potential/Land use related impacts						

4.7.7. Overall Cradle to Grave LCIA results for 1- tonne Hot Rolled Hexagon Wire Rod Coil

Table 35 Environmental impacts for 1-tonne Hot Rolled Hexagon Wire Rod Coil

Parameter	Unit	A1-A3	C1	C2	C3	C4	D
GWP - total	kg CO ₂ eq.	2.87E+03	0.00E+00	4.13E-03	0.00E+00	2.10E-03	-1.36E+03
GWP - fossil	kg CO ₂ eq.	2.91E+03	0.00E+00	3.96E-03	0.00E+00	2.28E-03	-1.36E+03
GWP - biogenic	kg CO ₂ eq.	-3.60E+01	0.00E+00	1.69E-04	0.00E+00	-1.80E-04	5.35E+00
GWP - luluc	kg CO ₂ eq.	5.33E-01	0.00E+00	2.13E-07	0.00E+00	6.55E-06	0.00E+00
ODP	kg CFC-11 eq.	5.67E-06	0.00E+00	2.05E-19	0.00E+00	8.44E-18	3.15E-05
AP	Mole of H ⁺ eq.	2.56E+01	0.00E+00	3.42E-05	0.00E+00	1.63E-05	-2.91E+00
EP - freshwater	kg P eq.	2.85E-04	0.00E+00	8.69E-10	0.00E+00	3.91E-09	5.10E-04
EP - marine	kg N eq.	4.10E+00	0.00E+00	1.59E-05	0.00E+00	4.20E-06	-4.37E-01
EP - terrestrial	Mole of N eq.	4.49E+01	0.00E+00	1.75E-04	0.00E+00	4.62E-05	-5.20E+00
POCP	kg NMVOC eq.	1.19E+01	0.00E+00	3.03E-05	0.00E+00	1.27E-05	-2.32E+00
ADPE	kg Sb eq.	1.45E-05	0.00E+00	4.27E-11	0.00E+00	2.04E-10	-7.06E-04
ADPF	MJ	3.42E+04	0.00E+00	5.49E-02	0.00E+00	2.99E-02	-1.21E+04
WDP	m ³ world equiv.	1.14E+02	0.00E+00	1.27E-05	0.00E+00	2.39E-04	-1.00E+02
Caption	GWP - total = global warming potential; GWP - fossil = global warming potential (fossil fuel only); GWP - biogenic = global warming potential (biogenic); GWP - luluc = global warming potential (land use only); ODP = ozone depletion; AP = acidification terrestrial and freshwater; EP freshwater = eutrophication potential (freshwater); EP - marine = eutrophication potential (marine); EP- terrestrial = eutrophication potential (terrestrial); POCP = photochemical ozone formation; ADPE = abiotic depletion potential (element), ADPF = abiotic depletion potential (fossil) WDP = water scarcity.						

Table 36 Parameters describing resource use for 1-tonne Hot Rolled Hexagon Wire Rod Coil

Parameter	Unit	A1-A3	C1	C2	C3	C4	D
PERE	MJ	8.92E+02	0.00E+00	1.96E-04	0.00E+00	3.91E-03	6.99E+02
PERM	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PERT	MJ	8.92E+02	0.00E+00	1.96E-04	0.00E+00	3.91E-03	6.99E+02
PENRE	MJ	3.42E+04	0.00E+00	5.49E-02	0.00E+00	2.99E-02	-1.21E+04
PENRM	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PENRT	MJ	3.42E+04	0.00E+00	5.49E-02	0.00E+00	2.99E-02	-1.21E+04
SM	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
RSF	MJ	2.90E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NRSF	MJ	4.40E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
FW	m ³ world equiv.	2.96E+00	0.00E+00	4.36E-07	0.00E+00	7.53E-06	-2.34E+00
Caption	PERE = Use of renewable primary energy excluding the renewable primary energy resource used as raw materials; PERM = Use of renewable primary energy as raw materials; PERT = Total use of renewable primary energy resources; PENRE = Use of non-renewable primary energy excluding the non-renewable primary energy resources used as raw materials; PENRM = Use of non-renewable primary energy used as raw materials; PENRT = Total use of non-renewable primary energy resources; SM = Use of secondary material; RSF = Use of renewable secondary fuels; NRSF = Use of non-renewable secondary fuels; FW = Use of net fresh water						

Table 37 Output flows and waste categories for 1-tonne Hot Rolled Hexagon Wire Rod Coil

Parameter	Unit	A1-A3	C1	C2	C3	C4	D
HWD	kg	1.55E-05	0.00E+00	2.93E-12	0.00E+00	4.55E-10	-1.31E-02
NHWD	kg	1.72E+01	0.00E+00	6.85E-07	0.00E+00	1.50E-01	-1.76E-01
RWD	kg	1.16E-01	0.00E+00	1.14E-08	0.00E+00	3.40E-07	-4.35E-01
MFR	kg	5.49E+02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
MER	kg	7.98E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
EEF	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
EET	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Caption	HWD = Hazardous waste disposed; NHWD = Non-hazardous waste disposed; RWD = Radioactive waste disposed; MFR = Materials for recycling; MER = Materials for energy recovery; EEF = Exported electrical energy; EET = Exported thermal energy						

Table 38 Additional environmental parameters for 1-tonne Hot Rolled Hexagon Wire Rod Coil

Parameter	Unit	A1-A3	C1	C2	C3	C4	D
PM	Disease incidences	5.78E-04	0.00E+00	2.22E-10	0.00E+00	2.02E-10	-1.85E-05
IR	kBq U235 eq.	1.18E+01	0.00E+00	1.08E-06	0.00E+00	3.50E-05	8.26E+00
ETF-fw	CTUe	5.02E+03	0.00E+00	1.89E-02	0.00E+00	1.71E-02	-6.17E+03
HTP-c	CTUh	3.05E-07	0.00E+00	3.24E-13	0.00E+00	2.53E-12	3.43E-07
HTP-nc	CTUh	2.92E-05	0.00E+00	1.54E-11	0.00E+00	2.78E-10	-2.28E-05
SQP	Pt	6.74E+02	0.00E+00	2.37E-04	0.00E+00	6.22E-03	7.13E-03
Caption	PM = Particulate matter emissions; IR = Ionising radiation, human health; ETF= Eco-toxicity (freshwater); HTP-c = Human toxicity, cancer effects; HTP-nc = Human toxicity, non-cancer effects; SQP = Soil quality potential/Land use related impacts						

4.7.8. Overall Cradle to Grave LCIA results for 1-tonne Hot Rolled Round Cornered Square**Table 39 Environmental impacts for 1-tonne Hot Rolled Round Cornered Square (RCS)**

Parameter	Unit	A1-A3	C1	C2	C3	C4	D
GWP - total	kg CO ₂ eq.	3.00E+03	0.00E+00	4.13E-03	0.00E+00	2.10E-03	-1.36E+03
GWP - fossil	kg CO ₂ eq.	3.04E+03	0.00E+00	3.96E-03	0.00E+00	2.28E-03	-1.36E+03
GWP - biogenic	kg CO ₂ eq.	3.58E+01	0.00E+00	1.69E-04	0.00E+00	-1.80E-04	5.35E+00
GWP - luluc	kg CO ₂ eq.	5.23E-01	0.00E+00	2.13E-07	0.00E+00	6.55E-06	0.00E+00
ODP	kg CFC-11 eq.	5.66E-06	0.00E+00	2.05E-19	0.00E+00	8.44E-18	3.15E-05
AP	Mole of H ⁺ eq.	2.56E+01	0.00E+00	3.42E-05	0.00E+00	1.63E-05	-2.91E+00
EP - freshwater	kg P eq.	3.20E-04	0.00E+00	8.69E-10	0.00E+00	3.91E-09	5.10E-04
EP - marine	kg N eq.	4.08E+00	0.00E+00	1.59E-05	0.00E+00	4.20E-06	-4.37E-01
EP - terrestrial	Mole of N eq.	4.47E+01	0.00E+00	1.75E-04	0.00E+00	4.62E-05	-5.20E+00
POCP	kg NMVOC eq.	1.18E+01	0.00E+00	3.03E-05	0.00E+00	1.27E-05	-2.32E+00
ADPE	kg Sb eq.	1.45E-05	0.00E+00	4.27E-11	0.00E+00	2.04E-10	-7.06E-04
ADPF	MJ	3.40E+04	0.00E+00	5.49E-02	0.00E+00	2.99E-02	-1.21E+04
WDP	m ³ world equiv.	1.04E+02	0.00E+00	1.27E-05	0.00E+00	2.39E-04	-1.00E+02
Caption	GWP - total = global warming potential; GWP - fossil = global warming potential (fossil fuel only); GWP - biogenic = global warming potential (biogenic); GWP - luluc = global warming potential (land use only); ODP = ozone depletion; AP = acidification terrestrial and freshwater; EP freshwater = eutrophication potential (freshwater); EP - marine = eutrophication potential (marine); EP- terrestrial = eutrophication potential (terrestrial); POCP = photochemical ozone formation; ADPE = abiotic depletion potential (element), ADPF = abiotic depletion potential (fossil) WDP = water scarcity.						

Table 40 Parameters describing resource use for 1-tonne Hot Rolled Round Cornered Square (RCS)

Parameter	Unit	A1-A3	C1	C2	C3	C4	D
PERE	MJ	8.86E+02	0.00E+00	1.96E-04	0.00E+00	3.91E-03	6.99E+02
PERM	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PERT	MJ	8.86E+02	0.00E+00	1.96E-04	0.00E+00	3.91E-03	6.99E+02
PENRE	MJ	3.40E+04	0.00E+00	5.49E-02	0.00E+00	2.99E-02	-1.21E+04
PENRM	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PENRT	MJ	3.40E+04	0.00E+00	5.49E-02	0.00E+00	2.99E-02	-1.21E+04
SM	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
RSF	MJ	2.90E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NRSF	MJ	4.40E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
FW	m ³ world equiv.	2.73E+00	0.00E+00	4.36E-07	0.00E+00	7.53E-06	-2.34E+00
Caption	PERE = Use of renewable primary energy excluding the renewable primary energy resource used as raw materials; PERM = Use of renewable primary energy as raw materials; PERT = Total use of renewable primary energy resources; PENRE = Use of non-renewable primary energy excluding the nonrenewable primary energy resources used as raw materials; PENRM = Use of non-renewable primary energy used as raw materials; PENRT = Total use of non-renewable primary energy resources; SM = Use of secondary material; RSF = Use of renewable secondary fuels; NRSF = Use of non-renewable secondary fuels; FW = Use of net fresh water						

Table 41 Output flows and waste categories for 1-tonne Hot Rolled Round Cornered Square (RCS)

Parameter	Unit	A1-A3	C1	C2	C3	C4	D
HWD	kg	1.58E-05	0.00E+00	2.93E-12	0.00E+00	4.55E-10	-1.31E-02
NHWD	kg	1.73E+01	0.00E+00	6.85E-07	0.00E+00	1.50E-01	-1.76E-01
RWD	kg	1.17E-01	0.00E+00	1.14E-08	0.00E+00	3.40E-07	-4.35E-01
MFR	kg	5.49E+02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
MER	kg	7.97E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
EEF	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
EET	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Caption	HWD = Hazardous waste disposed; NHWD = Non-hazardous waste disposed; RWD = Radioactive waste disposed; MFR = Materials for recycling; MER = Materials for energy recovery; EEF = Exported electrical energy; EET = Exported thermal energy						

Table 42 Additional environmental parameters for 1-tonne Hot Rolled Round Cornered Square (RCS)

Parameter	Unit	A1-A3	C1	C2	C3	C4	D
PM	Disease incidences	5.77E-04	0.00E+00	2.22E-10	0.00E+00	2.02E-10	-1.85E-05
IR	kBq U235 eq.	1.19E+01	0.00E+00	1.08E-06	0.00E+00	3.50E-05	8.26E+00
ETF-fw	CTUe	5.08E+03	0.00E+00	1.89E-02	0.00E+00	1.71E-02	-6.17E+03
HTP-c	CTUh	3.04E-07	0.00E+00	3.24E-13	0.00E+00	2.53E-12	3.43E-07
HTP-nc	CTUh	2.92E-05	0.00E+00	1.54E-11	0.00E+00	2.78E-10	-2.28E-05
SQP	Pt	6.66E+02	0.00E+00	2.37E-04	0.00E+00	6.22E-03	7.13E-03
Caption	PM = Particulate matter emissions; IR = Ionising radiation, human health; ETF= Eco-toxicity (freshwater); HTP-c = Human toxicity, cancer effects; HTP-nc = Human toxicity, non-cancer effects; SQP = Soil quality potential/Land use related impacts						

4.7.9. Overall Cradle to Grave LCIA results for 1- tonne Heat Treated Bar

Table 43 Environmental impacts for 1-tonne Heat Treated Bar

Parameter	Unit	A1-A3	C1	C2	C3	C4	D
GWP - total	kg CO ₂ eq.	3.07E+03	0.00E+00	4.13E-03	0.00E+00	2.10E-03	-1.36E+03
GWP - fossil	kg CO ₂ eq.	3.11E+03	0.00E+00	3.96E-03	0.00E+00	2.28E-03	-1.36E+03
GWP - biogenic	kg CO ₂ eq.	-3.60E+01	0.00E+00	1.69E-04	0.00E+00	-1.80E-04	5.35E+00
GWP - luluc	kg CO ₂ eq.	7.23E-01	0.00E+00	2.13E-07	0.00E+00	6.55E-06	0.00E+00
ODP	kg CFC-11 eq.	5.68E-06	0.00E+00	2.05E-19	0.00E+00	8.44E-18	3.15E-05
AP	Mole of H ⁺ eq.	2.70E+01	0.00E+00	3.42E-05	0.00E+00	1.63E-05	-2.91E+00
EP - freshwater	kg P eq.	3.72E-04	0.00E+00	8.69E-10	0.00E+00	3.91E-09	5.10E-04
EP - marine	kg N eq.	4.29E+00	0.00E+00	1.59E-05	0.00E+00	4.20E-06	-4.37E-01
EP - terrestrial	Mole of N eq.	4.70E+01	0.00E+00	1.75E-04	0.00E+00	4.62E-05	-5.20E+00
POCP	kg NMVOC eq.	1.25E+01	0.00E+00	3.03E-05	0.00E+00	1.27E-05	-2.32E+00
ADPE	kg Sb eq.	2.03E-05	0.00E+00	4.27E-11	0.00E+00	2.04E-10	-7.06E-04
ADPF	MJ	3.68E+04	0.00E+00	5.49E-02	0.00E+00	2.99E-02	-1.21E+04
WDP	m ³ world equiv.	1.24E+02	0.00E+00	1.27E-05	0.00E+00	2.39E-04	-1.00E+02
Caption	GWP - total = global warming potential; GWP - fossil = global warming potential (fossil fuel only); GWP - biogenic = global warming potential (biogenic); GWP - luluc = global warming potential (land use only); ODP = ozone depletion; AP = acidification terrestrial and freshwater; EP freshwater = eutrophication potential (freshwater); EP - marine = eutrophication potential (marine); EP- terrestrial = eutrophication potential (terrestrial); POCP = photochemical ozone formation; ADPE = abiotic depletion potential (element), ADPF = abiotic depletion potential (fossil) WDP = water scarcity.						

Table 44 Parameters describing resource use for 1-tonne Heat Treated Bar

Parameter	Unit	A1-A3	C1	C2	C3	C4	D
PERE	MJ	1.05E+03	0.00E+00	1.96E-04	0.00E+00	3.91E-03	6.99E+02
PERM	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PERT	MJ	1.05E+03	0.00E+00	1.96E-04	0.00E+00	3.91E-03	6.99E+02
PENRE	MJ	3.68E+04	0.00E+00	5.49E-02	0.00E+00	2.99E-02	-1.21E+04
PENRM	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PENRT	MJ	3.68E+04	0.00E+00	5.49E-02	0.00E+00	2.99E-02	-1.21E+04
SM	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
RSF	MJ	2.90E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NRSF	MJ	4.40E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
FW	m ³ world equiv.	3.32E+00	0.00E+00	4.36E-07	0.00E+00	7.53E-06	-2.34E+00
Caption	PERE = Use of renewable primary energy excluding the renewable primary energy resource used as raw materials; PERM = Use of renewable primary energy as raw materials; PERT = Total use of renewable primary energy resources; PENRE = Use of non-renewable primary energy excluding the non-renewable primary energy resources used as raw materials; PENRM = Use of non-renewable primary energy used as raw materials; PENRT = Total use of non-renewable primary energy resources; SM = Use of secondary material; RSF = Use of renewable secondary fuels; NRSF = Use of non-renewable secondary fuels; FW = Use of net fresh water						

Table 45 Output flows and waste categories for 1-tonne Heat Treated Bar

Parameter	Unit	A1-A3	C1	C2	C3	C4	D
HWD	kg	1.62E-05	0.00E+00	2.93E-12	0.00E+00	4.55E-10	-1.31E-02
NHWD	kg	1.76E+01	0.00E+00	6.85E-07	0.00E+00	1.50E-01	-1.76E-01
RWD	kg	1.28E-01	0.00E+00	1.14E-08	0.00E+00	3.40E-07	-4.35E-01
MFR	kg	5.46E+02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
MER	kg	7.99E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
EEF	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
EET	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Caption	HWD = Hazardous waste disposed; NHWD = Non-hazardous waste disposed; RWD = Radioactive waste disposed; MFR = Materials for recycling; MER = Materials for energy recovery; EEF = Exported electrical energy; EET = Exported thermal energy						

Table 46 Additional environmental parameters for 1-tonne Heat Treated Bar

Parameter	Unit	A1-A3	C1	C2	C3	C4	D
PM	Disease incidences	6.00E-04	0.00E+00	2.22E-10	0.00E+00	2.02E-10	-1.85E-05
IR	kBq U235 eq.	1.28E+01	0.00E+00	1.08E-06	0.00E+00	3.50E-05	8.26E+00
ETF-fw	CTUe	5.43E+03	0.00E+00	1.89E-02	0.00E+00	1.71E-02	-6.17E+03
HTP-c	CTUh	3.27E-07	0.00E+00	3.24E-13	0.00E+00	2.53E-12	3.43E-07
HTP-nc	CTUh	3.02E-05	0.00E+00	1.54E-11	0.00E+00	2.78E-10	-2.28E-05
SQP	Pt	9.03E+02	0.00E+00	2.37E-04	0.00E+00	6.22E-03	7.13E-03
Caption	PM = Particulate matter emissions; IR = Ionising radiation, human health; ETF= Eco-toxicity (freshwater); HTP-c = Human toxicity, cancer effects; HTP-nc = Human toxicity, non-cancer effects; SQP = Soil quality potential/Land use related impacts						

4.7.10. Overall Cradle to Grave LCIA results for 1- tonne Heat Treated Wire Rod Coil**Table 47 Environmental impacts for 1-tonne Heat Treated Wire Rod Coil**

Parameter	Unit	A1-A3	C1	C2	C3	C4	D
GWP - total	kg CO ₂ eq.	3.07E+03	0.00E+00	4.13E-03	0.00E+00	2.10E-03	-1.36E+03
GWP - fossil	kg CO ₂ eq.	3.11E+03	0.00E+00	3.96E-03	0.00E+00	2.28E-03	-1.36E+03
GWP - biogenic	kg CO ₂ eq.	-3.60E+01	0.00E+00	1.69E-04	0.00E+00	-1.80E-04	5.35E+00
GWP - luluc	kg CO ₂ eq.	7.23E-01	0.00E+00	2.13E-07	0.00E+00	6.55E-06	0.00E+00
ODP	kg CFC-11 eq.	5.68E-06	0.00E+00	2.05E-19	0.00E+00	8.44E-18	3.15E-05
AP	Mole of H ⁺ eq.	2.70E+01	0.00E+00	3.42E-05	0.00E+00	1.63E-05	-2.91E+00
EP - freshwater	kg P eq.	3.72E-04	0.00E+00	8.69E-10	0.00E+00	3.91E-09	5.10E-04
EP - marine	kg N eq.	4.29E+00	0.00E+00	1.59E-05	0.00E+00	4.20E-06	-4.37E-01
EP - terrestrial	Mole of N eq.	4.70E+01	0.00E+00	1.75E-04	0.00E+00	4.62E-05	-5.20E+00
POCP	kg NMVOC eq.	1.25E+01	0.00E+00	3.03E-05	0.00E+00	1.27E-05	-2.32E+00
ADPE	kg Sb eq.	2.03E-05	0.00E+00	4.27E-11	0.00E+00	2.04E-10	-7.06E-04
ADPF	MJ	3.68E+04	0.00E+00	5.49E-02	0.00E+00	2.99E-02	-1.21E+04
WDP	m ³ world equiv.	1.24E+02	0.00E+00	1.27E-05	0.00E+00	2.39E-04	-1.00E+02
Caption	GWP - total = global warming potential; GWP - fossil = global warming potential (fossil fuel only); GWP - biogenic = global warming potential (biogenic); GWP - luluc = global warming potential (land use only); ODP = ozone depletion; AP = acidification terrestrial and freshwater; EP freshwater = eutrophication potential (freshwater); EP - marine = eutrophication potential (marine); EP- terrestrial = eutrophication potential (terrestrial); POCP = photochemical ozone formation; ADPE = abiotic depletion potential (element), ADPF = abiotic depletion potential (fossil) WDP = water scarcity.						

Table 48 Parameters describing resource use for 1-tonne Heat Treated Wire Rod Coil

Parameter	Unit	A1-A3	C1	C2	C3	C4	D
PERE	MJ	1.05E+03	0.00E+00	1.96E-04	0.00E+00	3.91E-03	6.99E+02
PERM	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PERT	MJ	1.05E+03	0.00E+00	1.96E-04	0.00E+00	3.91E-03	6.99E+02
PENRE	MJ	3.68E+04	0.00E+00	5.49E-02	0.00E+00	2.99E-02	-1.21E+04
PENRM	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PENRT	MJ	3.68E+04	0.00E+00	5.49E-02	0.00E+00	2.99E-02	-1.21E+04
SM	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
RSF	MJ	2.90E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NRSF	MJ	4.40E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
FW	m ³ world equiv.	3.32E+00	0.00E+00	4.36E-07	0.00E+00	7.53E-06	-2.34E+00
Caption	PERE = Use of renewable primary energy excluding the renewable primary energy resource used as raw materials; PERM = Use of renewable primary energy as raw materials; PERT = Total use of renewable primary energy resources; PENRE = Use of non-renewable primary energy excluding the non-renewable primary energy resources used as raw materials; PENRM = Use of non-renewable primary energy used as raw materials; PENRT = Total use of non-renewable primary energy resources; SM = Use of secondary material; RSF = Use of renewable secondary fuels; NRSF = Use of non-renewable secondary fuels; FW = Use of net fresh water						

Table 49 Output flows and waste categories for 1-tonne Heat Treated Wire Rod Coil

Parameter	Unit	A1-A3	C1	C2	C3	C4	D
HWD	kg	1.62E-05	0.00E+00	2.93E-12	0.00E+00	4.55E-10	-1.31E-02
NHWD	kg	1.76E+01	0.00E+00	6.85E-07	0.00E+00	1.50E-01	-1.76E-01
RWD	kg	1.28E-01	0.00E+00	1.14E-08	0.00E+00	3.40E-07	-4.35E-01
MFR	kg	5.46E+02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
MER	kg	7.99E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
EEF	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
EET	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Caption	HWD = Hazardous waste disposed; NHWD = Non-hazardous waste disposed; RWD = Radioactive waste disposed; MFR = Materials for recycling; MER = Materials for energy recovery; EEF = Exported electrical energy; EET = Exported thermal energy						

Table 50 Additional environmental parameters for 1-tonne Heat Treated Wire Rod Coil

Parameter	Unit	A1-A3	C1	C2	C3	C4	D
PM	Disease incidences	6.00E-04	0.00E+00	2.22E-10	0.00E+00	2.02E-10	-1.85E-05
IR	kBq U235 eq.	1.28E+01	0.00E+00	1.08E-06	0.00E+00	3.50E-05	8.26E+00
ETF-fw	CTUe	5.43E+03	0.00E+00	1.89E-02	0.00E+00	1.71E-02	-6.17E+03
HTP-c	CTUh	3.27E-07	0.00E+00	3.24E-13	0.00E+00	2.53E-12	3.43E-07
HTP-nc	CTUh	3.02E-05	0.00E+00	1.54E-11	0.00E+00	2.78E-10	-2.28E-05
SQP	Pt	9.03E+02	0.00E+00	2.37E-04	0.00E+00	6.22E-03	7.13E-03
Caption	PM = Particulate matter emissions; IR = Ionising radiation, human health; ETF= Eco-toxicity (freshwater); HTP-c = Human toxicity, cancer effects; HTP-nc = Human toxicity, non-cancer effects; SQP = Soil quality potential/Land use related impacts						

4.8 Interpretation

The interpretation of the results of Average of Finished Long Products (Steel) is given in below Tables.

Vijayanagar

Table 51 Interpretation of most significant contributors to life cycle parameters – Wire Rod

Parameter	Most significant contributor
Global Warming Potential (GWP) -Total	The GWP - Total in A1- A3 stages is 2.59E+03 kg CO ₂ equiv., 6.23E- kg CO ₂ equiv. in C1-C4 stages and -1.36E+03 kg CO ₂ equiv. in D stage. In A1- A3 stages, BF (~20.7%), WRM (~16.6%) and Coke ovens (~16.33%) contribute the most.
Global Warming Potential (GWP) - fossil	The GWP- fossil in A1- A3 stages is 2.59E+03 kg CO ₂ equiv., 6.23E-03 kg CO ₂ equiv. in C1-C4 stages and -1.36E+03 kg CO ₂ equiv. in D stage. In A1- A3 stages, BF (~20.7%), WRM (~16.6%) and Coke ovens (~16.33%) contribute the most.
Global Warming Potential (GWP) - luluc	The GWP - luluc in A1- A3 stages is 3.81E-01 kg CO ₂ equiv., 6.76E-06 kg CO ₂ equiv. in C1-C4 stages and 0.00E+00 kg CO ₂ equiv in D stage. In A1- A3 stages, Coke ovens (~42.83%) and Corex (~11.90%) contribute the most.
Ozone depletion	The Ozone depletion in A1- A3 stages is 1.60E-06 kg CFC11-equiv., 8.64E-18 kg CFC11-equiv. in C1-C4 stages and 3.15E-05 kg CFC11-equiv in D stage. In A1- A3 stages, BOF (~82.80%), contribute the most.
Acidification terrestrial and freshwater	The Acidification - terrestrial and freshwater in A1- A3 stages is 2.21E+01 Mole of H ⁺ eq., 5.05E-05 Mole of H ⁺ eq. in C1-C4 stages and -2.91E+00 Mole of H ⁺ eq. in D stage. In A1- A3 stages, Coke ovens (~43.91%) and Corex (~13.30%) contribute the most.
Eutrophication freshwater	The Eutrophication - freshwater in A1- A3 stages is 2.57E-04 kg P eq., 4.78E-09 kg P eq. in C1-C4 Stages and 5.10E-04 kg P eq. in D stage. In A1- A3 stages, Coke ovens (~23.4%), BOF (~19.4%) and EAF (~19.3%) contribute the most.
Eutrophication marine	The Eutrophication - marine in A1- A3 stages is 3.76E+00 kg N eq., 2.01E-05 kg N eq. in C1-C4 Stages and -4.37E-01 kg N eq. in D stage. In A1- A3 stages, Coke oven (~41.98%), Corex (~12.6%) and Sinter plant (~12.30%) contribute the most.
Eutrophication terrestrial	The Eutrophication - terrestrial in A1- A3 stages 4.12E+01 Mole of N eq., 2.21E-04 Mole of N eq. in C1-C4 stages and -5.20E+00 Mole of N eq. in D stage. In A1- A3 stages, Coke ovens (~41.98%), Corex (~12.6%) and Sinter plant (~12.30%) contribute the most.
Photochemical ozone formation - human health	The Photochemical ozone formation - human health in A1- A3 stages 1.08E+01 kg NMVOC eq., 4.30E-05 kg NMVOC eq. in C1-C4 stages and -2.32E+00 kg NMVOC eq. in D stage. In A1- A3 stages, Coke ovens (~42.1%), Corex (~12.6%) and Sinter plant (~12.80%) contribute the most.
Abiotic Resource Depletion (ADP) - fossil	The ADP - fossil in A1- A3 stages 3.12E+04 MJ, 8.47E-02 MJ in C1-C4 stages and -1.21E+04 MJ in D stage. In A1- A3 stages, Coke ovens (~36.0%) and BF (~30.6%) contribute the most.
Water scarcity (WDP)	The WDP in A1- A3 stages 5.37E+01 m ³ world equiv., 2.51E-04 m ³ world equiv. in C1-C4 stages and -1.00E+02 m ³ world equiv. in D stage. In A1- A3 stages, WRM (~31.3%), Coke ovens (~15.78%) and BOF (~14.2%) contribute the most.

Dolvi**Table 52 Interpretation of most significant contributors to life cycle parameters – TMT Bar**

Parameter	Most significant contributor
Global Warming Potential (GWP) -Total	The GWP - Total in A1- A3 stages is 3.25E+03 kg CO ₂ equiv., 6.23E- kg CO ₂ equiv. in C1-C4 stages and -1.36E+03 kg CO ₂ equiv. in D stage. In A1- A3 stages, BF (~38.8%) and SMS+ConArc (~24.7%) contribute the most.
Global Warming Potential (GWP) - fossil	The GWP - fossil in A1- A3 stages is 3.24E+03 kg CO ₂ equiv., 6.23E-03 kg CO ₂ equiv. in C1-C4 stages and -1.36E+03 kg CO ₂ equiv. in D stage. In A1- A3 stages, BF (~38.8%) and SMS+ConArc (~24.7%) contribute the most.
Global Warming Potential (GWP) - luluc	The GWP - luluc in A1- A3 stages is 8.18E-01 kg CO ₂ equiv., 6.76E-06 kg CO ₂ equiv. in C1-C4 stages and 0.00E+00 kg CO ₂ equiv in D stage. In A1- A3 stages, SMS+ConArc (~37.8%), Coke ovens (~16.7%) and BF (~15.9%) contribute the most.
Ozone depletion	The Ozone depletion in A1- A3 stages is 1.74E-06 kg CFC11-equiv., 8.64E-18 kg CFC11-equiv. in C1-C4 stages and 3.15E-05 kg CFC11-equiv in D stage. In A1- A3 stages, SMS+ConArc (~96.9%) contribute the most.
Acidification terrestrial and freshwater	The Acidification - terrestrial and freshwater in A1- A3 stages is 2.67E+01 Mole of H ⁺ eq., 5.05E-05 Mole of H ⁺ eq. in C1-C4 stages and -2.91E+00 Mole of H ⁺ eq. in D stage. In A1- A3 stages, BF (~20.0%) and Coke ovens (~44.6%) contribute the most.
Eutrophication freshwater	The Eutrophication - freshwater in A1- A3 stages is 5.07E-04 kg P eq., 4.78E-09 kg P eq. in C1-C4 Stages and 5.10E-04 kg P eq. in D stage. In A1- A3 stages, SMS+ConArc (~32.9%), Coke ovens (~21.38%) and BF (~18.6%) contribute the most.
Eutrophication marine	The Eutrophication - marine in A1- A3 stages is 4.00E+00 kg N eq., 2.01E-05 kg N eq. in C1-C4 Stages and -4.37E-01 kg N eq. in D stage. In A1- A3 stages, Coke ovens (~47.9%) and BF (~20.1%) contribute the most.
Eutrophication terrestrial	The Eutrophication - terrestrial in A1- A3 stages 4.39E+01 Mole of N eq., 2.21E-04 Mole of N eq. in C1-C4 stages and -5.20E+00 Mole of N eq. in D stage. In A1- A3 stages, Coke ovens (~47.9%) and BF (~20.1%) contribute the most.
Photochemical ozone formation - human health	The Photochemical ozone formation - human health in A1- A3 stages 1.17E+01kg NMVOC eq., 4.30E-05 kg NMVOC eq. in C1-C4 stages and -2.32E+00 kg NMVOC eq. in D stage. In A1- A3 stages, Coke ovens (~47.2%) and BF (~20.0%) contribute the most.
Abiotic Resource Depletion (ADP) - fossil	The ADP - fossil in A1- A3 stages 2.74E+04 MJ, 8.47E-02 MJ in C1-C4 stages and -1.21E+04 MJ in D stage. In A1- A3 stages, Coke ovens (~43.0%) and BF (~18.6%) contribute the most.
Water scarcity (WDP)	The WDP in A1- A3 stages 2.71E+02 m ³ world equiv., 2.51E-04 m ³ world equiv. in C1-C4 stages and -1.00E+02 m ³ world equiv. in D stage. In A1- A3 stages, SMS+ConArc (~35.1%), BRM (~23.9%) and BF (~23.5%) contribute the most.

Salem

Table 53 Interpretation of most significant contributors to life cycle parameters –Hot Rolled Wire Rod Coil

Parameter	Most significant contributor
Global Warming Potential (GWP) -Total	The GWP - Total in A1- A3 stages is 2.87E+03 kg CO ₂ equiv., 6.23E- kg CO ₂ equiv. in C1-C4 stages and -1.36E+03 kg CO ₂ equiv. in D stage. In A1- A3 stages, Coke ovens (~33.7%) and BF (~28.8%) contribute the most.
Global Warming Potential (GWP) - fossil	The GWP - fossil in A1- A3 stages is 2.91E+03 kg CO ₂ equiv., 6.23E-03 kg CO ₂ equiv. in C1-C4 stages and -1.36E+03 kg CO ₂ equiv. in D stage. In A1- A3 stages, Coke ovens (~33.7%) and BF (~28.5%) contribute the most.
Global Warming Potential (GWP) - luluc	The GWP - luluc in A1- A3 stages is 5.33E-01 kg CO ₂ equiv., 6.76E-06 kg CO ₂ equiv. in C1-C4 stages and 0.00E+00 kg CO ₂ equiv in D stage. In A1- A3 stages, Coke ovens (~59.5%) and SMS plant (~14.5%) contribute the most.
Ozone depletion	The Ozone depletion in A1- A3 stages is 5.67E-06 kg CFC11-equiv., 8.64E-18 kg CFC11-equiv. in C1-C4 stages and 3.15E-05 kg CFC11-equiv in D stage. In A1- A3 stages, SMS plant (~97.6%) contribute the most.
Acidification terrestrial and freshwater	The Acidification - terrestrial and freshwater in A1- A3 stages is 2.56E+01 Mole of H ⁺ eq., 5.05E-05 Mole of H ⁺ eq. in C1-C4 stages and -2.91E+00 Mole of H ⁺ eq. in D stage. In A1- A3 stages, Coke ovens (~82.8%) contribute the most.
Eutrophication freshwater	The Eutrophication - freshwater in A1- A3 stages is 2.85E-04 kg P eq., 4.78E-09 kg P eq. in C1-C4 Stages and 5.10E-04 kg P eq. in D stage. In A1- A3 stages, Coke ovens (~44.1%) and SMS plant (~24.9%) contribute the most.
Eutrophication marine	The Eutrophication - marine in A1- A3 stages is 4.10E+00 kg N eq., 2.01E-05 kg N eq. in C1-C4 Stages and -4.37E-01 kg N eq. in D stage. In A1- A3 stages, Coke ovens (~85.3%) contribute the most.
Eutrophication terrestrial	The Eutrophication - terrestrial in A1- A3 stages 4.49E+01 Mole of N eq., 2.21E-04 Mole of N eq. in C1-C4 stages and -5.20E+00 Mole of N eq. in D stage. In A1- A3 stages, Coke ovens (~85.2%) contribute the most.
Photochemical ozone formation - human health	The Photochemical ozone formation - human health in A1- A3 stages 1.19E+01 kg NMVOC eq., 4.30E-05 kg NMVOC eq. in C1-C4 stages and -2.32E+00 kg NMVOC eq. in D stage. In A1- A3 stages, Coke ovens (~84.6%) contribute the most.
Abiotic Resource Depletion (ADP) - fossil	The ADP - fossil in A1- A3 stages 3.42E+04 MJ, 8.47E-02 MJ in C1-C4 stages and -1.21E+04 MJ in D stage. In A1- A3 stages, Coke ovens (~69.4%) and BF (~20.1%) contribute the most.
Water scarcity (WDP)	The WDP in A1- A3 stages 1.14E+02 m ³ world equiv., 2.51E-04 m ³ world equiv. in C1-C4 stages and -1.00E+02 m ³ world equiv. in D stage. In A1- A3 stages, SMS plant (~33.6%), BRM (~27.7%) and BF (~20.1%) contribute the most.

Concluding, the study provides fair understanding of environmental impacts during the various life cycle stages of Finished Long Steel production. It also identifies the hot spots in the value chain where improvement activities can be prioritised and accordingly investment can be planned. The scope covers the ecological information to be divided into raw material production, transportation, steel production as well as the end-of-life stage considerations. Major focus areas should align to optimise the coke consumption in blast furnaces, coal consumption in CO plants and COREX gas consumption in DRI plant.

5. LCA Terminology

Cradle to Gate	Scope of study extends from mining of natural resources to the completed product ready for shipping from the manufacturing dispatch “gate”, known as Modules A1-A3.
Cradle to Grave	Scope of study extends from mining of natural resources to manufacture, use and disposal of products at End of Life, including all Modules A-D.
End of life	Post-use phase life cycle stages involving collection and processing of materials (e.g. scrap) and recycling or disposal, known as Modules C and D.

6. Other Environmental Information

The constituent materials used within our products are responsibly sourced and we apply the principles of Sustainable Development and of Environmental Stewardship as a standard business practice in our operations. Protecting the environment by preserving non-renewable natural resources, increasing energy efficiency, reducing the environmental emissions, limiting the impact of materials transportation to and from our operations is part of our way in doing business.

7. References

- EN 15804:2012+A2:2019, Sustainability of construction works - Environmental product declarations - Core rules for the product category of construction products
- GaBi 10 Software system <https://gabi.sphera.com/>
- ISO 14020:2000 Environmental labels and declarations - General principles
- ISO 14025:2006 Environmental labels and declarations - Type III environmental declarations - Principles and procedures
- ISO 14040:2006 Environmental management- Life cycle assessment - Principles and framework
- ISO 14044:2006 Environmental management - Life cycle assessment - Requirements and guidelines.
- Sphera Solutions Inc. (2020). GaBi LCA Database Documentation. Retrieved from GaBi Solutions: <https://www.gabi-software.com/databases/gabi-databases/>
- WSI and Eurofer's Co-product Allocation Methodology 2014 - A methodology to determine the LCI of Steel industry Co-products.
- World Steel Association - CO₂ Data Collection User Guide, Version 9 (May 2019).