EPD®
THE INTERNATIONAL EPD® SYSTEM

JSW

Environmental Product Declaration

In Accordance with ISO 14025:2006 and EN 15804:2012+A2:2019

Average of Finished Flat Products (Steel)

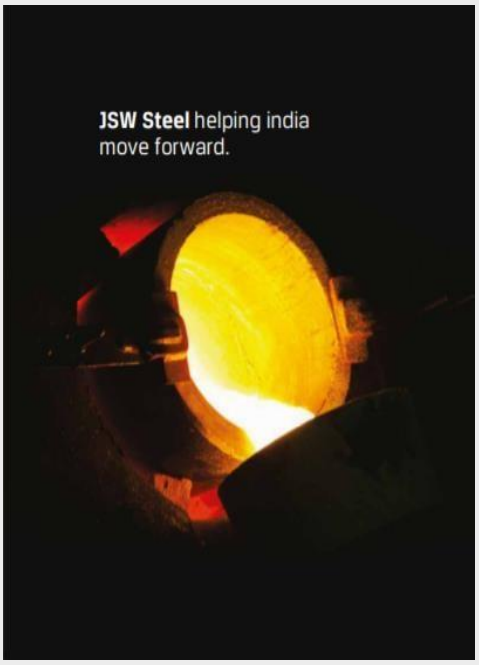
ECO PLATFORM EPD VERIFIED

INDIA EPD®
THE INTERNATIONAL EPD SYSTEM

EPD registration number	Publication date	Validity date	Geographical scope
S-P-05017	2022-01-11	2027-01-10	India

1. Introduction

Founded in 1982, JSW Group is one of India's largest business conglomerates. It is a part of the US $15 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 Flat products (Cold rolled coated GA and GI coil and sheets, Non-oriented Electrical steel, Hot Rolled Coils, Hot Rolled Flat) 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 Flat 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	Swaroop Banerjee JSW Steel Limited, JSW Centre - 6th Floor, Bandra Kurla Complex Bandra (East), Mumbai – 400051, Maharashtra Email: swaroop.banerjee@jsw.in
Product	Finished Flat Products (Steel) (Cold rolled coated GA and GI coil and sheets, Non-oriented electrical steel, Hot rolled coils, Hot rolled flat)
CPC Code	41239, Version 2.1
EPD registration number	S-P-05017
Publication date	2022-01-11
Validity date	2027-01-10
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**
Date of Issue	2021-02-05 (Version 1.11)

Table 3. Verification Information

Demonstration of verification	**External, independent verification**
Third party verifier	Dr. Hüdai 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 Average of Finished Flat 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 Finished Steel 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 Flat 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 Flat Products (Steel)

Manufacturing Unit	Product	Size (mm)	Grades
Vijayanagar	Cold Rolled Coated GA and GI Coil and Sheets	Thickness: 0.35 - 2.3 Width: 900 - 1850	270C to 980Y
	Non-oriented Electrical Steel	0.65 x 1350 0.50 x 1500 0.35 x 1350 0.50 x 1500	65C1000 - 65C350 50C1000 - 50C290 35C360 - 35C250 50SP1050 - 50SP450
Dolvi	Hot Rolled Coils	Thickness: 1.6 – 25.0 & Width: 900 – 1560 Thickness: 1.6 – 16.0 & Width: 900 – 1650	• Re-rolling/ Drawing Grades • Tube and Pipe/ Forming Grades • Structural/Medium Tensile Tube/ Forming Grades • LPG/ Low Pressure Vessel Grades • HSLA Grades • Medium/High Carbon Grades • Weather Resistance Grades • Line Pipe Grades • Chequered Grades
Salem	Hot Rolled Flat	60 x 7 to 101 x 38	Spring steel, Medium carbon low alloy steel,Micro alloy steel

Table 6 Chemical composition of Finished Flat Products (Steel)

Manufacturing Unit	Product	Chemical Composition
Vijayanagar	Cold Rolled Coated GA and GI Coil and Sheets	0.0005-0.25 C%, 0.1-2.5 Mn%, 0.005-0.4 Si%, 0.015-0.15 Al%, 0.0005-0.045 S%, 0.003-0.6 P%, 0.0-0.3 Ti%, 0.0-0.10 Nb%
	Non-oriented Electrical Steel	0.0-0.06 C%, 0.1-1.0 Mn%, 0.0-0.025 S%, 0.0-0.12 P%, 0.0-3.2 Si%, 0.0-1.0 Al%, 0.0-0.04 Ni%, 0.0-0.04 Cr%, 0.0-0.04 Cu%, 0.0-0.12 Sb%, 0.0-0.005 Ti%, 0.0-0.005 V%, 0.0-0.005 Nb%, 0.0-0.010 N%, 0.0-0.005 Ca%
Dolvi	Hot Rolled Coils	0.0-0.99 C%, 0.0-4.0 Mn%, 0.0-0.99 S%, 0.0-0.99 P%, 0.0-9.99 Si%, 0.0-0.99 Al%, 0.0-0.99 Ti%, 0.0-0.99 V%, 0.0-0.99 Nb%, 0.0-0.012 N%, 0.0-0.099 B%
Salem	Hot Rolled Flat	0.10-1.10 C%, 0.25-2.10 Mn%, 0.10-2.10 Si%, 0.0-0.05 P%, 0.0-0.065 S%, 0.025-2.50 Cr%, 0.0-1.10 Mo% 0.0-0.0005 B%, 0.0-3.75 Ni%, 0.02-0.30 V%

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.

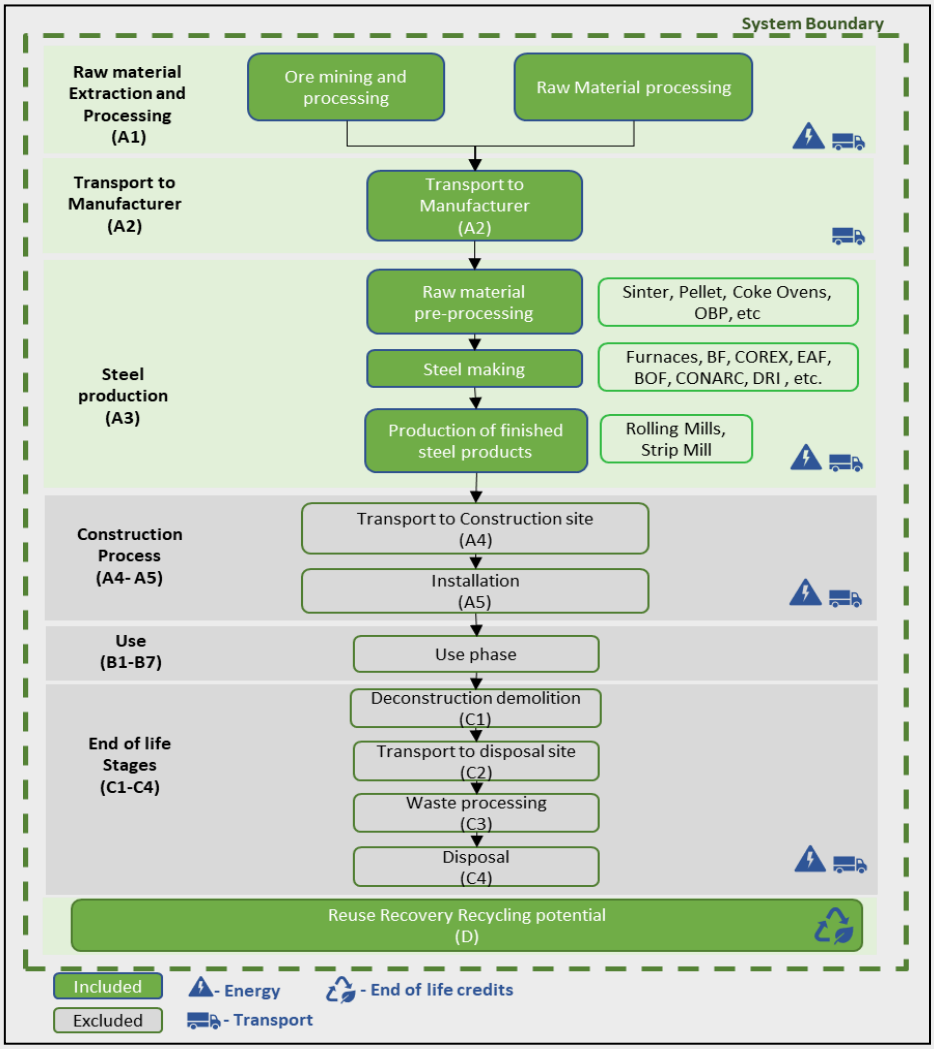


Figure 1 System Boundary Diagram (Cradle to Gate)

3.3 Process Description

Vijayanagar

Products are manufactured using the Blast Furnace with Basic Oxygen Furnace (BF+BOF) route. Ironore (typical mix based on Ferro-oxides Fe_2O_3), Pellets and other additives are mixed and sintered forbeing 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 alloyingwith micro-alloying elements is applied according to steel grade to give the requested characteristics for the steel. The production also includes the Electric Arc Furnace (EAF) route. The raw material inputconsists 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 semi-finished product in acontinuously casted steel slab. The semi-finished slab is then hot rolled into the coils in hot strip mills(HSM) and further sent to Cold Rolling Mills (CRM) for making Cold rolled coated GA and GI coil andsheets and Non-oriented electrical steel.

CRM has two routes one having Reverse Type Rolling Cold Rolling Process with Batch Annealing andother having Tandem Cold Rolling Process with Continuous Annealing. The subsequent process involves finishing and inspection of the final product. The product is then dispatched and sent for shipping.

Dolvi

The Dolvi unit features a sponge iron plant, one CONARC furnace, two blast furnaces, two pellet plants, two coke-oven plants, two sinter plants, one thin slab casting & rolling mill, one hot strip mill, oxygen plants and lime calcining plants. Hot metal is made using Sinter, Pellet and lumps in Blast Furnaces and Pellets are used making DRI. Subsequently, Steel is made using with CONARC and Basic Oxygen Furnace route.

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 circularcooling machine. The cooled sinter is screened to separate the fines. Pellets are fed into DRI and blastfurnace along with raw materials (ore, sinter, coke) which are screened before being charged into theblast 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.

CONARC process is based on the increaseduse of hot metal in the electric arc furnace and is aimed at optimizing energy recovery and maximizingproductivity in such an operation. The process uses various mix of raw materials like hot metal, DirectReduced Iron (DRI) and scrap to ensure highest quality requirements for the production of all gradesand qualities of steels covering a wide range from carbon steels to stainless steels.

In BOF process, 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 & DRI (up to 15%) are added to the melt. Refining (lowering of sulphur, phosphorous and other tramp elements) and alloyingwith 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 and decarburization, few steel products are processed through the RH Degassing unit. The hot iron produced in the Blast Furnace and Direct Reduced Iron (DRI) is transferred into Steel Melting Shop (SMS) and CONARC & BOF to produce liquid steel. CONARC & BOF 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. Then slabs are sent to Hot Strip Mill (HSM) for productions of Hot Rolled Coil.

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 unitsto 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 bloom and billet. The Bloom are sent to Blooming mill for production of HotRolled Flat.

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

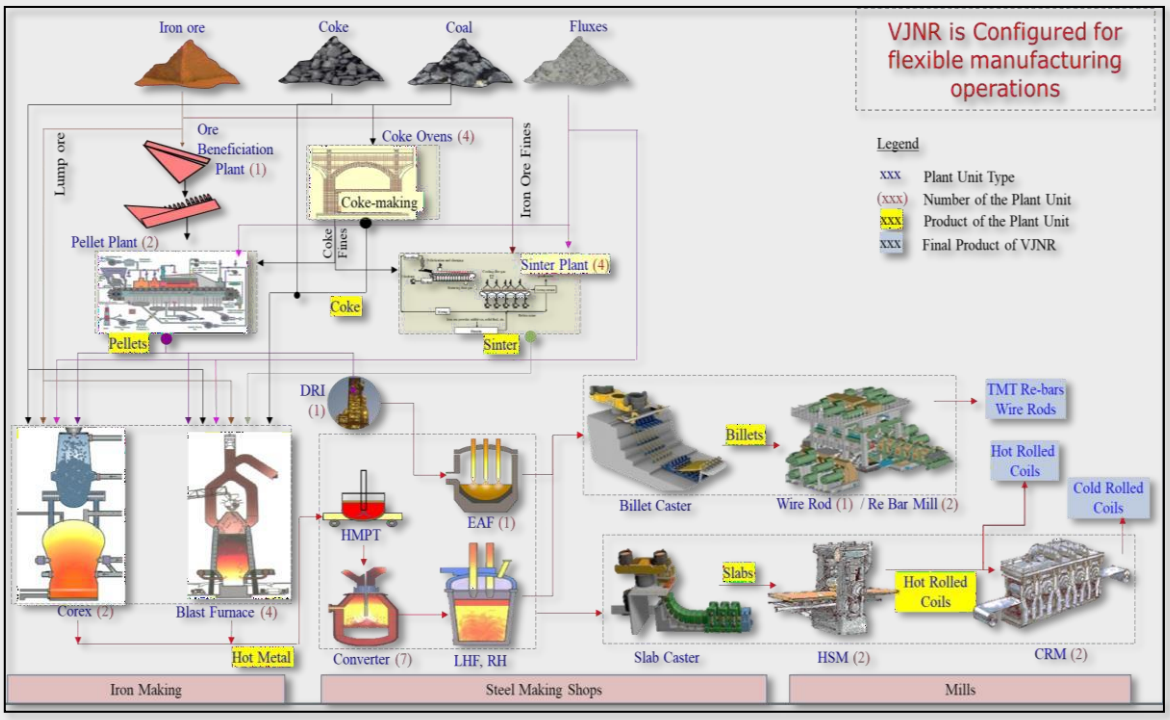


Figure 2 Steel making process at JSW Steel – Vijayanagar

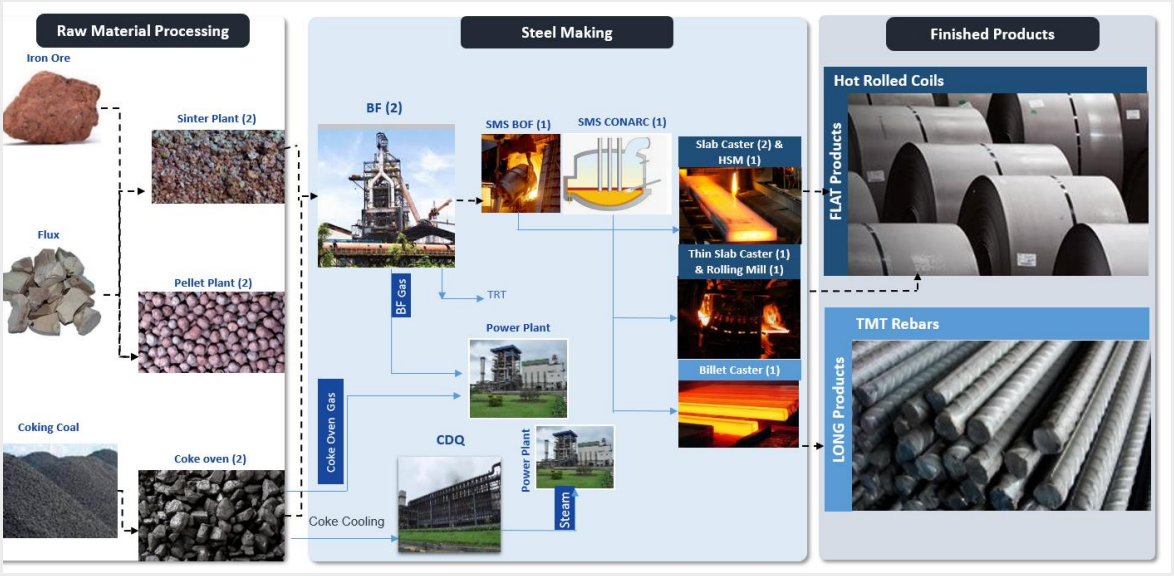


Figure 3 Steel making process at JSW Steel – Dolvi

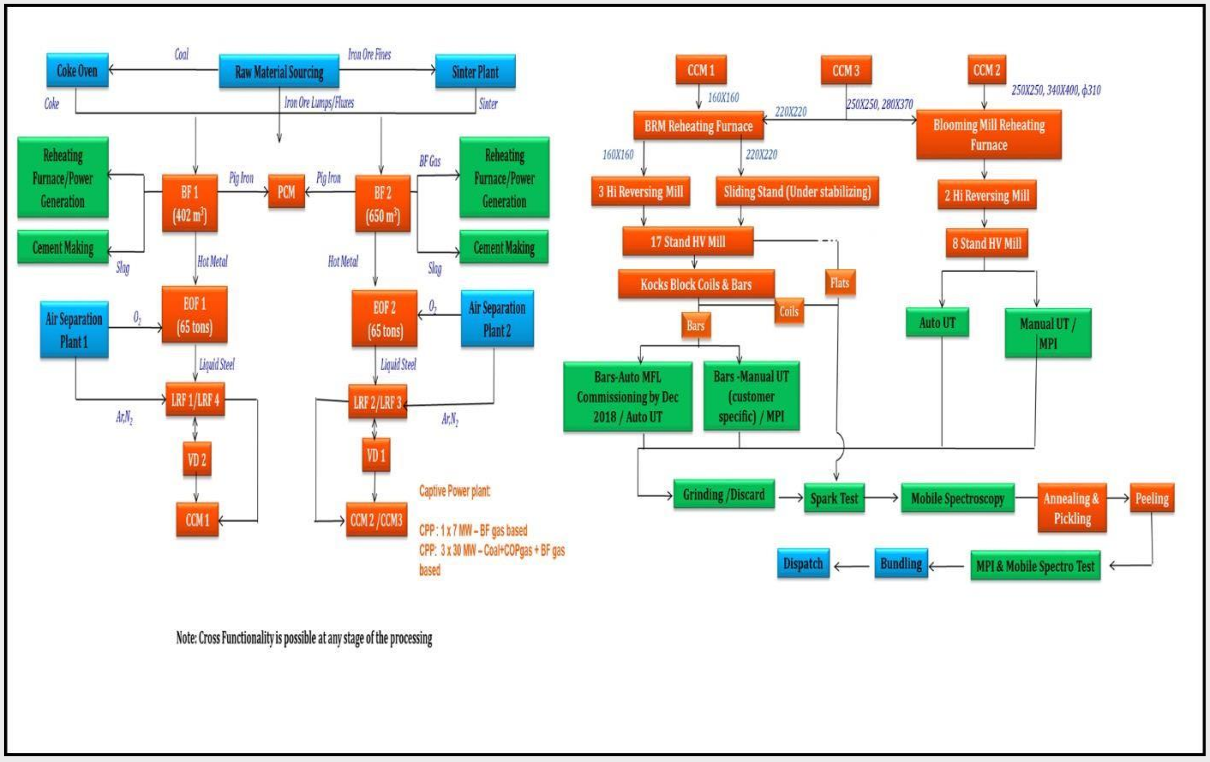


Figure 4 Steel making process at JSW Steel – Salem

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.

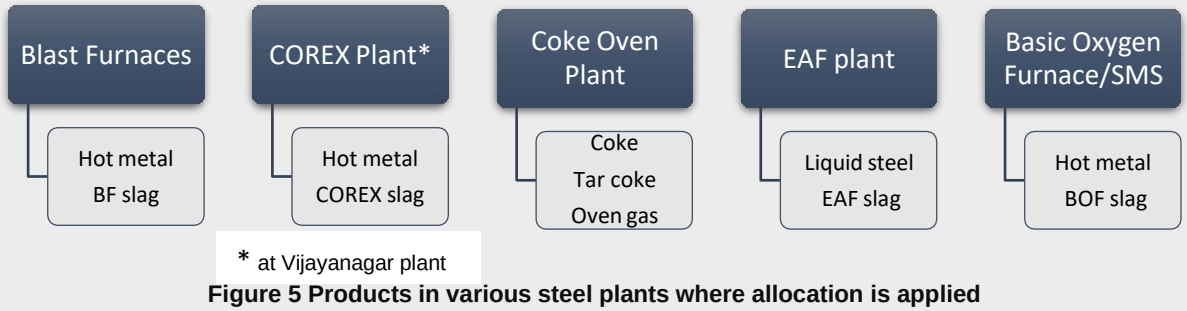


Figure 5 Products in various steel plants where allocation is applied

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 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 1 tonne of Average of 4 Finished Flat 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. The environmental impact per declared unit for the following environmental impact categories were reported in the EPD according with EN 15804+A2 (Table 7), and divided into core, upstream (and downstream, if included) module.

Table 7 Environmental impacts indicators

Impact category	Indicator	Unit
Climate change	Global Warming Potential total (GWP-total)	kg CO_2 eq.
Climate change (fossil)	Global Warming Potential fossil fuels (GWP-fossil)	kg CO_2 eq.
Climate change (biogenic)	Global Warming Potential biogenic (GWP-biogenic)	kg CO_2 eq.
Climate change (luluc)	Global Warming Potential land use and land use change (GWP-luluc)	kg CO_2 eq.
Ozone depletion	Depletion potential of the stratospheric ozone layer (ODP)	kg CFC-11 eq.
Acidification terrestrial and freshwater	Acidification potential, Accumulated Exceedance (AP)	Mole of H^+ eq.
Eutrophication freshwater	Eutrophication potential, fraction of nutrients reaching freshwater end compartment (EP-freshwater)	kg P eq.
Eutrophication marine	Eutrophication potential, fraction of nutrients reaching marine end compartment (EP-marine)	kg N eq.
Eutrophication terrestrial	Eutrophication potential, Accumulated Exceedance (EP-terrestrial)	Mole of N eq.
Photochemical ozone formation - human health	Formation potential of tropospheric ozone (POCP)	kg NMVOC eq.
Resource use, mineral and metals	Abiotic depletion potential for non-fossil resources (ADP- minerals & metals)	kg Sb eq.
Resource use, energy carriers	Abiotic depletion for fossil resources potential (ADP-fossil)	MJ
Water scarcity	Water (user) deprivation potential, deprivation-weighted water consumption (WDP)	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 pro-cess 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 and BOF 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; MND=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 Flat products (steel) manufactured at JSW Steel - Vijayanagar, Dolvi and Salem plants are given in below Tables.

4.7.1. Results for 1- tonne Cold Rolled Coated GA and GI Coil and Sheets - Vijayanagar

Table 11 Environmental impacts for 1- tonne Cold Rolled Coated GA and GI Coil and Sheets

Parameter	Unit	A1-A3	C1	C2	C3	C4	D
GWP-total	kg CO_2 eq.	2.76E+03	0.00E+00	4.13E-03	0.00E+00	2.10E-03	-1.36E+03
GWP-fossil	kg CO_2 eq.	2.76E+03	0.00E+00	3.96E-03	0.00E+00	2.28E-03	-1.36E+03
GWP-biogenic	kg CO_2 eq.	7.61E-02	0.00E+00	1.69E-04	0.00E+00	-1.80E-04	5.35E+00
GWP-luluc	kg CO_2 eq.	4.00E-01	0.00E+00	2.13E-07	0.00E+00	6.55E-06	0.00E+00
ODP	kg CFC-11 eq.	1.65E-06	0.00E+00	2.05E-19	0.00E+00	8.44E-18	3.15E-05
AP	Mole of H^+ eq.	2.31E+01	0.00E+00	3.42E-05	0.00E+00	1.63E-05	-2.91E+00
EP-freshwater	kg P eq.	2.78E-04	0.00E+00	8.69E-10	0.00E+00	3.91E-09	5.10E-04
EP-freshwater	kg PO_4 eq.	8.53E-04	0.00E+00	2.67E-09	0.00E+00	1.20E-08	1.57E-03
EP-marine	kg N eq.	3.94E+00	0.00E+00	1.59E-05	0.00E+00	4.20E-06	-4.37E-01
EP-terrestrial	Mole of N eq.	4.32E+01	0.00E+00	1.75E-04	0.00E+00	4.62E-05	-5.20E+00
POCP	kg NMVOC eq.	1.13E+01	0.00E+00	3.03E-05	0.00E+00	1.27E-05	-2.32E+00
ADPE	kg Sb eq.	4.79E-05	0.00E+00	4.27E-11	0.00E+00	2.04E-10	-7.06E-04
ADPF	MJ	3.25E+04	0.00E+00	5.49E-02	0.00E+00	2.99E-02	-1.21E+04
WDP	m^3 world equiv.	5.27E+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- terrestric = eutrophication potential (terrestrial); POCP = photochemical ozone formation; ADPE = abiotic depletion potential (element), ADPF = abiotic depletion potential (fossil) WDP = water scarcity.
Disclaimer: EP-freshwater indicator has also been calculated as “kg P eq” as required in the characterization model (EUTREND model, Struijs et al., 2009b, as implemented in ReCiPe; http://eplca.jrc.ec.europa.eu/LCDN/developerEF.xhtml) in addition to “kg PO_4 eq” as stated in the standard.

Table 12 Parameters describing resource use for 1-tonne Cold Rolled Coated GA and GI Coil and Sheets

Parameter	Unit	A1-A3	C1	C2	C3	C4	D
PERE	MJ	2.94E+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	2.94E+02	0.00E+00	1.96E-04	0.00E+00	3.91E-03	6.99E+02
PENRE	MJ	3.25E+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	3.25E+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	6.32E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NRSF	MJ	9.61E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
FW	m^3 world equiv.	3.02E+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 Cold Rolled Coated GA and GI Coil and Sheets

Parameter	Unit	A1-A3	C1	C2	C3	C4	D
HWD	kg	1.42E-05	0.00E+00	2.93E-12	0.00E+00	4.55E-10	-1.31E-02
NHWD	kg	1.65E+01	0.00E+00	6.85E-07	0.00E+00	1.50E-01	-1.76E-01
RWD	kg	4.59E-02	0.00E+00	1.14E-08	0.00E+00	3.40E-07	-4.35E-01
MFR	kg	2.67E+02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
MER	kg	-4.43E-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	-3.63E+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; EEE = Exported electrical energy; EET = Exported thermal energy

Table 14 Additional environmental parameters for 1-tonne Cold Rolled Coated GA and GI Coil and Sheets

Parameter	Unit	A1-A3	C1	C2	C3	C4	D
PM	Disease incidences	5.20E-04	0.00E+00	2.22E-10	0.00E+00	2.02E-10	-1.85E-05
IR	kBq U235 eq.	4.64E+00	0.00E+00	1.08E-06	0.00E+00	3.50E-05	8.26E+00
ETF-fw	CTUe	3.78E+03	0.00E+00	1.89E-02	0.00E+00	1.71E-02	-6.17E+03
HTP-c	CTUh	2.38E-07	0.00E+00	3.24E-13	0.00E+00	2.53E-12	3.43E-07
HTP-nc	CTUh	1.77E-05	0.00E+00	1.54E-11	0.00E+00	2.78E-10	-2.28E-05
SQP	Pt	5.81E+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. Results for 1- tonne Non-oriented Electrical Steel - Vijayanagar

Table 15 Environmental impacts for 1- tonne Non-oriented Electrical Steel

Parameter	Unit	A1-A3	C1	C2	C3	C4	D
GWP-total	kg CO_2 eq.	2.76E+03	0.00E+00	4.13E-03	0.00E+00	2.10E-03	-1.36E+03
GWP-fossil	kg CO_2 eq.	2.76E+03	0.00E+00	3.96E-03	0.00E+00	2.28E-03	-1.36E+03
GWP-biogenic	kg CO_2 eq.	7.61E-02	0.00E+00	1.69E-04	0.00E+00	-1.80E-04	5.35E+00
GWP-luluc	kg CO_2 eq.	4.00E-01	0.00E+00	2.13E-07	0.00E+00	6.55E-06	0.00E+00
ODP	kg CFC-11 eq.	1.65E-06	0.00E+00	2.05E-19	0.00E+00	8.44E-18	3.15E-05
AP	Mole of H^+ eq.	2.31E+01	0.00E+00	3.42E-05	0.00E+00	1.63E-05	-2.91E+00
EP-freshwater	kg P eq.	2.78E-04	0.00E+00	8.69E-10	0.00E+00	3.91E-09	5.10E-04
EP-freshwater	kg PO_4 eq.	8.53E-04	0.00E+00	2.67E-09	0.00E+00	1.20E-08	1.57E-03
EP-marine	kg N eq.	3.94E+00	0.00E+00	1.59E-05	0.00E+00	4.20E-06	-4.37E-01
EP-terrestrial	Mole of N eq.	4.32E+01	0.00E+00	1.75E-04	0.00E+00	4.62E-05	-5.20E+00
POCP	kg NMVOC eq.	1.13E+01	0.00E+00	3.03E-05	0.00E+00	1.27E-05	-2.32E+00
ADPE	kg Sb eq.	4.79E-05	0.00E+00	4.27E-11	0.00E+00	2.04E-10	-7.06E-04
ADPF	MJ	3.25E+04	0.00E+00	5.49E-02	0.00E+00	2.99E-02	-1.21E+04
WDP	m^3 world equiv.	5.27E+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- terrestric = eutrophication potential

(terrestrial); POCP = photochemical ozone formation; ADPE = abiotic depletion potential (element), ADPF = abiotic depletion potential (fossil) WDP = water scarcity.
Disclaimer: EP-freshwater indicator has also been calculated as "kg P eq" as required in the characterization model (EUTREND model, Struijs et al., 2009b, as implemented in ReCiPe; http://eplca.jrc.ec.europa.eu/LCDN/developerEF.xhtml) in addition to "kg PO_4 eq" as stated in the standard.

Table 16 Parameters describing resource use for 1-tonne Non-oriented Electrical Steel

Parameter	Unit	A1-A3	C1	C2	C3	C4	D
PERE	MJ	2.94E+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	2.94E+02	0.00E+00	1.96E-04	0.00E+00	3.91E-03	6.99E+02
PENRE	MJ	3.25E+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	3.25E+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	6.32E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NRSF	MJ	9.61E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
FW	m^3 world equiv.	3.02E+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 Non-oriented Electrical Steel

Parameter	Unit	A1-A3	C1	C2	C3	C4	D
HWD	kg	1.42E-05	0.00E+00	2.93E-12	0.00E+00	4.55E-10	-1.31E-02
NHWD	kg	1.65E+01	0.00E+00	6.85E-07	0.00E+00	1.50E-01	-1.76E-01
RWD	kg	4.59E-02	0.00E+00	1.14E-08	0.00E+00	3.40E-07	-4.35E-01
MFR	kg	2.67E+02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
MER	kg	-4.43E-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	-3.63E+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; EEE = Exported electrical energy; EET = Exported thermal energy

Table 18 Additional environmental parameters for 1-tonne Non-oriented Electrical Steel

Parameter	Unit	A1-A3	C1	C2	C3	C4	D
PM	Disease incidences	5.20E-04	0.00E+00	2.22E-10	0.00E+00	2.02E-10	-1.85E-05
IR	kBq U235 eq.	4.64E+00	0.00E+00	1.08E-06	0.00E+00	3.50E-05	8.26E+00
ETF-fw	CTUe	3.78E+03	0.00E+00	1.89E-02	0.00E+00	1.71E-02	-6.17E+03
HTP-c	CTUh	2.38E-07	0.00E+00	3.24E-13	0.00E+00	2.53E-12	3.43E-07
HTP-nc	CTUh	1.77E-05	0.00E+00	1.54E-11	0.00E+00	2.78E-10	-2.28E-05
SQP	Pt	5.81E+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

4.7.3. Results for 1- tonne Hot Rolled Coils – Dolvi

Table 19 Environmental impacts for 1- tonne Hot Rolled Coils

Parameter	Unit	A1-A3	C1	C2	C3	C4	D
GWP-total	kg CO_2 eq.	2.96E+03	0.00E+00	4.13E-03	0.00E+00	2.10E-03	-1.36E+03
GWP-fossil	kg CO_2 eq.	2.96E+03	0.00E+00	3.96E-03	0.00E+00	2.28E-03	-1.36E+03
GWP-biogenic	kg CO_2 eq.	8.64E-01	0.00E+00	1.69E-04	0.00E+00	-1.80E-04	5.35E+00
GWP-luluc	kg CO_2 eq.	7.74E-01	0.00E+00	2.13E-07	0.00E+00	6.55E-06	0.00E+00
ODP	kg CFC-11 eq.	1.72E-06	0.00E+00	2.05E-19	0.00E+00	8.44E-18	3.15E-05
AP	Mole of H^+ eq.	2.51E+01	0.00E+00	3.42E-05	0.00E+00	1.63E-05	-2.91E+00
EP-freshwater	kg P eq.	4.81E-04	0.00E+00	8.69E-10	0.00E+00	3.91E-09	5.10E-04
EP-freshwater	kg PO_4 eq.	1.48E-03	0.00E+00	2.67E-09	0.00E+00	1.20E-08	1.57E-03
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.	1.10E+01	0.00E+00	3.03E-05	0.00E+00	1.27E-05	-2.32E+00
ADPE	kg Sb eq.	1.22E-04	0.00E+00	4.27E-11	0.00E+00	2.04E-10	-7.06E-04
ADPF	MJ	2.58E+04	0.00E+00	5.49E-02	0.00E+00	2.99E-02	-1.21E+04
WDP	m^3 world equiv.	2.33E+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- terrestric = eutrophication potential (terrestrial); POCP = photochemical ozone formation; ADPE = abiotic depletion potential (element), ADPF = abiotic depletion potential (fossil) WDP = water scarcity.
Disclaimer: EP-freshwater indicator has also been calculated as “kg P eq” as required in the characterization model (EUTREND model, Struijs et al., 2009b, as implemented in ReCiPe; http://eplca.jrc.ec.europa.eu/LCDN/developerEF.xhtml) in addition to “kg PO_4 eq” as stated in the standard.

Table 20 Parameters describing resource use for 1-tonne Hot Rolled Coils

Parameter	Unit	A1-A3	C1	C2	C3	C4	D
PERE	MJ	8.06E+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	8.06E+02	0.00E+00	1.96E-04	0.00E+00	3.91E-03	6.99E+02
PENRE	MJ	2.58E+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	2.58E+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.	5.48E+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 Hot Rolled Coils

Parameter	Unit	A1-A3	C1	C2	C3	C4	D
HWD	kg	2.66E-05	0.00E+00	2.93E-12	0.00E+00	4.55E-10	-1.31E-02
NHWD	kg	1.59E+01	0.00E+00	6.85E-07	0.00E+00	1.50E-01	-1.76E-01
RWD	kg	1.02E-01	0.00E+00	1.14E-08	0.00E+00	3.40E-07	-4.35E-01
MFR	kg	3.78E+02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
MER	kg	-1.81E+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; EEE = Exported electrical energy; EET = Exported thermal energy

Table 22 Additional environmental parameters for 1-tonne Hot Rolled Coils

Parameter	Unit	A1-A3	C1	C2	C3	C4	D
PM	Disease incidences	8.54E-04	0.00E+00	2.22E-10	0.00E+00	2.02E-10	-1.85E-05
IR	kBq U235 eq.	9.97E+00	0.00E+00	1.08E-06	0.00E+00	3.50E-05	8.26E+00
ETF-fw	CTUe	2.88E+03	0.00E+00	1.89E-02	0.00E+00	1.71E-02	-6.17E+03
HTP-c	CTUh	2.84E-07	0.00E+00	3.24E-13	0.00E+00	2.53E-12	3.43E-07
HTP-nc	CTUh	1.83E-05	0.00E+00	1.54E-11	0.00E+00	2.78E-10	-2.28E-05
SQP	Pt	1.61E+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

4.7.4. Results for 1- tonne Hot Rolled Flat - Salem

Table 23 Environmental impacts for 1- tonne Hot Rolled Flat

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-freshwater	kg PO_4 eq.	9.83E-04	0.00E+00	2.67E-09	0.00E+00	1.20E-08	1.57E-03
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- terrestric = eutrophication potential

(terrestrial); POCP = photochemical ozone formation; ADPE = abiotic depletion potential (element), ADPF = abiotic depletion potential (fossil) WDP = water scarcity.
Disclaimer: EP-freshwater indicator has also been calculated as "kg P eq" as required in the characterization model (EUTREND model, Struijs et al., 2009b, as implemented in ReCiPe; http://eplca.jrc.ec.europa.eu/LCDN/developerEF.xhtml) in addition to "kg PO_4 eq" as stated in the standard.

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

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 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 Flat

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; EEE = Exported electrical energy; EET = Exported thermal energy

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

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

4.8 Interpretation

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

Vijayanagar

Table 27 Interpretation of most significant contributors to life cycle parameters – Cold Rolled Coated GA and GI Coil and Sheets

Parameter	Most significant contributor
Global Warming Potential (GWP) - total	The GWP - total in A1- A3 stages is 2.76E+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 (~21.3%), Coke ovens (~17.6%) and BOF (~12.6%) contribute the most.
Global Warming Potential (GWP) - fossil	The GWP- fossil in A1- A3 stages is 2.76E+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 (~21.3%), Coke ovens (~17.6%) and BOF (~12.6%) contribute the most.
Global Warming Potential (GWP) - luluc	The GWP - luluc in A1- A3 stages is 4.00E-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 (~47.7%) and Corex (~12.2%) contribute the most.
Ozone Depletion Potential (ODP)	The ODP in A1- A3 stages is 1.65E-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 (~85.0%), contribute the most.
Acidification Potential (AP) - terrestrial and freshwater	The AP - terrestrial and freshwater in A1- A3 stages is 2.31E+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 (~46.2%) and Corex (~13.6%) contribute the most.
Eutrophication Potential (EP) - freshwater	The EP - freshwater in A1- A3 stages is 2.78E-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 (~24.6%), BOF (~19.9%) and EAF (~19.8%) contribute the most.
Eutrophication Potential (EP) - marine	The EP - marine in A1- A3 stages is 3.94E+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 (~44.2%), Corex (~12.9%) and Sinter plant (~12.6%) contribute the most.
Eutrophication Potential (EP) - terrestrial	The EP - terrestrial in A1- A3 stages 4.32E+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 oven (~44.2%), Corex (~12.9%) and Sinter plant (~12.6%) contribute the most.
Photochemical Ozone Creation Potential (POCP) - human health	The POCP - human health in A1- A3 stages 1.13E+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 oven (~44.3%), Corex (~12.9%) and Sinter plant (~12.2%) contribute the most.
Abiotic Resource Depletion Potential (ADP) - fossil	The ADP - fossil in A1- A3 stages 3.25E+04 MJ, 8.47E-02 MJ in C1-C4 stages and -1.21E+04 MJ in D stage. In A1- A3 stages, Coke ovens (~37.8%) and BF (~31.4%) contribute the most.
Water Scarcity Potential (WDP)	The WDP in A1- A3 stages 5.27E+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, HSM (~32.4%), Coke ovens (~16.6%) and BOF (~14.5%) contribute the most.

Dolvi

Table 28 Interpretation of most significant contributors to life cycle parameters – Hot Rolled Coil

Parameter	Most significant contributor
Global Warming Potential (GWP) - total	The GWP - total in A1- A3 stages is 2.96E+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 (~38.3%) and SMS (ConArc / BOF) (~24.3%) contribute the most.
Global Warming Potential (GWP) - fossil	The GWP - fossil in A1- A3 stages is 2.96E+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 (~38.3%) and SMS (ConArc / BOF) (~24.3%) contribute the most.
Global Warming Potential (GWP) - luluc	The GWP - luluc in A1- A3 stages is 7.74E-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 / BOF) (~37.3%), BF (~15.6%) and Coke ovens (~15.1%)contribute the most.
Ozone Depletion Potential (ODP)	The ODP in A1- A3 stages is 1.72E-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 / BOF) (~95.6%) contribute the most.
Acidification Potential (AP) - terrestrial and freshwater	The AP- terrestrial and freshwater in A1- A3 stages is 2.51E+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 (~40.0%), BF (~19.7%) and SMS (ConArc / BOF) (~17.4%) contribute the most.
Eutrophication Potential (EP) - freshwater	The EP - freshwater in A1- A3 stages is 4.81E-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 / BOF) (~32.5%), Coke ovens (~19.2%) and BF (~18.4%) contributethe most.
Eutrophication Potential (EP) - marine	The EP - 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 ovens (~42.9%) and BF (~19.8%) contribute the most.
Eutrophication Potential (EP) - terrestrial	The EP - 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 (~42.9%) and BF (~19.8%) contribute the most.
Photochemical Ozone Creation Potential (POCP) - human health	The POCP - human health in A1- A3 stages 1.10E+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 (~42.2%) and BF (~19.7%) contribute the most.
Abiotic Resource Depletion Potential (ADP) - fossil	The ADP - fossil in A1- A3 stages 2.58E+04 MJ, 8.47E-02 MJ in C1-C4 stages and -1.21E+04 MJ in D stage. In A1- A3 stages, Coke ovens (~37.4%), BF (~18.3%) and SMS (ConArc / BOF) (~15.0%) contribute the most.
Water Scarcity Potential (WDP)	The WDP in A1- A3 stages 2.33E+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 / BOF) (~34.7%), BF (~23.2%) and HSM (~10.0%) contributethe most.

Salem

Table 29 Interpretation of most significant contributors to life cycle parameters – Hot Rolled Flat

Parameter	Most significant contributor
Global Warming Potential (GWP) - total	The GWP - total in A1- A3 stages is 3.00E+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 (~34.1%) and BF (~28.8%) contribute the most.
Global Warming Potential (GWP) - fossil	The GWP - fossil in A1- A3 stages is 3.04E+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 5.23E-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 Potential (ODP)	The ODP in A1- A3 stages is 5.66E-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 Potential (AP) - terrestrial and freshwater	The AP - 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 Potential (EP) - freshwater	The EP - freshwater in A1- A3 stages is 3.20E-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 Potential (EP) - marine	The EP - marine in A1- A3 stages is 4.08E+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 Potential (EP) - terrestrial	The EP - terrestrial in A1- A3 stages 4.47E+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 Creation Potential (POCP) - human health	The POCP - human health in A1- A3 stages 1.18E+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 Potential (ADP) - fossil	The ADP - fossil in A1- A3 stages 3.40E+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 (~16.1%) contribute the most.
Water Scarcity Potential (WDP)	The WDP in A1- A3 stages 1.04E+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.

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/
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