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JSW

Environmental Product Declaration

Galvalume Steel Product,
Kalmeshwar Plant, JSWSCPL

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

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EPD Registration Number	Publication Date	Validity Date	Geographical Scope
S-P-06478	2023-08-07	2028-08-06	India

1. Introduction

Founded in 2013, JSW Steel Coated Products Limited (JSWSCPL) is India's largest manufacturer and exporter of colour-coated steel products with a total production capacity of 3.12 MTPA with the capability to produce 1.4 MTPA of Colour Coated Steel. The vision of the company "Nurture Leadership in Coated Products by creating value for Stakeholders in an Environmentally Sustainable way" has been developed from the parent company. JSWSPCL is a wholly owned subsidiary of JSW Steel, having state of the art manufacturing facilities at Vasind, Tarapur & Kalmeshwar in Maharashtra. The facilities at Vasind & Tarapur plants are located near major ports & Kalmeshwar plant is centrally located near Nagpur to serve customers across the nation. With a strong focus on sustainability and innovation, JSWSCPL dominates the value-added product market. The product portfolio is vast as the products can be obtained in different hues, textures and finishes.

Following are the products offered by JSWSCPL, Kalmeshwar:

- Galvanized Steel.
- Galvalume Steel.
- Pre painted Galvanized Steel (PPGI).
- Pre painted Galvalume Steel (PPGL).

The Company has been at the forefront of state-of-the-art, cutting-edge technology, research and innovation while laying the foundation for long-term growth. JSWSCPL have strategic collaborations with global technology leaders to offer high-value special steel products for various applications across construction, infrastructure, automobile, appliances and other sectors.

JSW Steel Coated Products Limited (JSWSCPL) is committed towards their environmental, social and governance (ESG) goals to create sustainable long-term value for all stakeholders. With sustainability at the core of the corporate strategy, JSWSCPL strive to be a force for good, driven by responsible business conduct that enhances the lives of communities and nurtures the environment.

Thinkstep Sustainability Solutions Pvt. Ltd, a Sphera Company (formerly thinkstep AG). has been entrusted to conduct Life Cycle Assessment for JSW Steel Coated products as per the ISO 14040/44. The LCA model was created using the GaBi ts Software system for life cycle engineering, developed by Sphera (formerly thinkstep AG).

2. General Information

Environmental Product Declaration in accordance with ISO 14025:2006 and EN 15804:2012+A2:2019/AC:2021.

2.1 EPD, PCR, LCA Information

Table 1: EPD Information

Programme	The International EPD System, www.environdec.com	
Program operator	EPD International AB Box 210 60, SE-100 31 Stockholm, Sweden info@environdec.com	Indian Regional Hub www.environdecindia.com
Declaration holder[1]	Name - Mr. Swaroop Banerjee JSW Steel Coated Products Limited (JSWSCPL) JSW Centre - 6th Floor, Bandra Kurla Complex Bandra (East), Mumbai – 400051, Maharashtra Email - swaroop.banerjee@jsw.in Website - www.jsw.in	
Product	Galvalume	
CPC Code	412 (Version 2.1)	
Geographical scope	India	
Reference standards	ISO 14020:2001, ISO 14025:2006, EN 15804:2012+A2:2019	

Table 2: PCR Information

Reference PCR	'Construction Products and Construction Services' Version 1.2.5, 2019:14
Date of Issue	2022-07-08 (Version 1.2.5) (VALID UNTIL: 2024-12-20)

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 of Galvalume Steel
Author	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

[1] EPD owner has the sole ownership, liability, and responsibility for the EPD.

2.2 Reference Period of EPD Data

The reference period for the primary data (foreground data) used within this EPD is FY April 2021 - March 2022. The background data used in the study have been applied through GaBi datasets which are less than 5 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 Galvalume Steel product at JSW Steel Coated Products Limited's Kalmeshwar plant in India. The EPD is in accordance with ISO 14025 and EN 15804+A2. EPD of construction products may not be comparable if they do not comply with EN 15804+A2. The Life Cycle Assessment (LCA) study carried out for developing this EPD for Galvalume steel product is done as per ISO 14040 and ISO 14044 requirements.

Product Category Rules (PCR) for the assessment of the environmental performance of steel products is PCR for 'Construction Products and Construction Services' 1.2.5, (2022-11-01).

This PCR is applicable to the product "Galvalume" complying with the standard EN 15804+A2 (Sustainability of construction works - Environmental product declarations - Core rules for the product category of construction products).

EPDs within the same product category but registered in different EPD programmes, or not compliant with EN 15804, may not be comparable. For two EPDs to be comparable, they must be based on the same PCR (including the same version number) or be based on fully-aligned PCRs or versions of PCRs; cover products with identical functions, technical performances and use (e.g. identical declared/functional units); have equivalent system boundaries and descriptions of data; apply equivalent data quality requirements, methods of data collection, and allocation methods; apply identical cut-off rules and impact assessment methods (including the same version of characterisation factors); have equivalent content declarations; and be valid at the time of comparison. For further information about comparability, see EN 15804 and ISO 14025.

3. Product Description and System Boundaries

3.1 Product Identification and Usage

JSW Steel Coated Products Limited (JSWSCPL) is the first licensee galvalume producer in India that uses technology from BIEC International Inc., USA. This technology license gives the edge over others by providing continuous access to the latest product innovations and process refinements through BIEC and the ZAC Association, which enable JSWSCPL to manufacture products of the highest quality.

The alloy-coated product contains 55% aluminium, 43.5% zinc and 1.5% silicon by weight. Made with the traditional hot-dipping process, Galvalume is a suitable match for applications that demand high corrosion resistance and heat reflectivity. They can use it across applications like construction, appliances, agricultural equipment, and several non-exposed automotive components.

<u>Galvalume:</u>

Galvalume steel composition, which combines the galvanic corrosion resistance of zinc with the barrier corrosion resistance of aluminium, this product was discovered by Bethlehem Steel Corporation after an extensive research program. The coating's unique microstructure embeds zinc rich areas within an aluminium rich matrix which, while allowing zinc to provide galvanic protection, restricts its dissolution.

Galvalume steel can be used for roofs of all types and pitches and can be employed for walls. It is recommended for any new building where a cost-effective maintenance for roofing system is required. Excellent resistance to corrosion and good heat reflectivity makes Galvalume steel the preferred choice for farm building, roofing, and siding applications. The appearance can be further enhanced with the use of pre-painted Galvalume sheet.

Table 5: Content Declaration

Product Component	Weight, %	Biogenic material, weight % and kg C/kg
Steel	97%	--
Zinc	1%	-
Al-Si alloy	2%	-
Polymer	-	-
Pigment	-	-
Sum	100%	
Packaging Materials	**Weight, %**	**Biogenic material, weight % and kg C/kg**
Paper	32%	0.42
Plastic	68%	-
Sum	100%	

3.2 System boundary

Figure 1 given below represents system boundary diagram of the study.

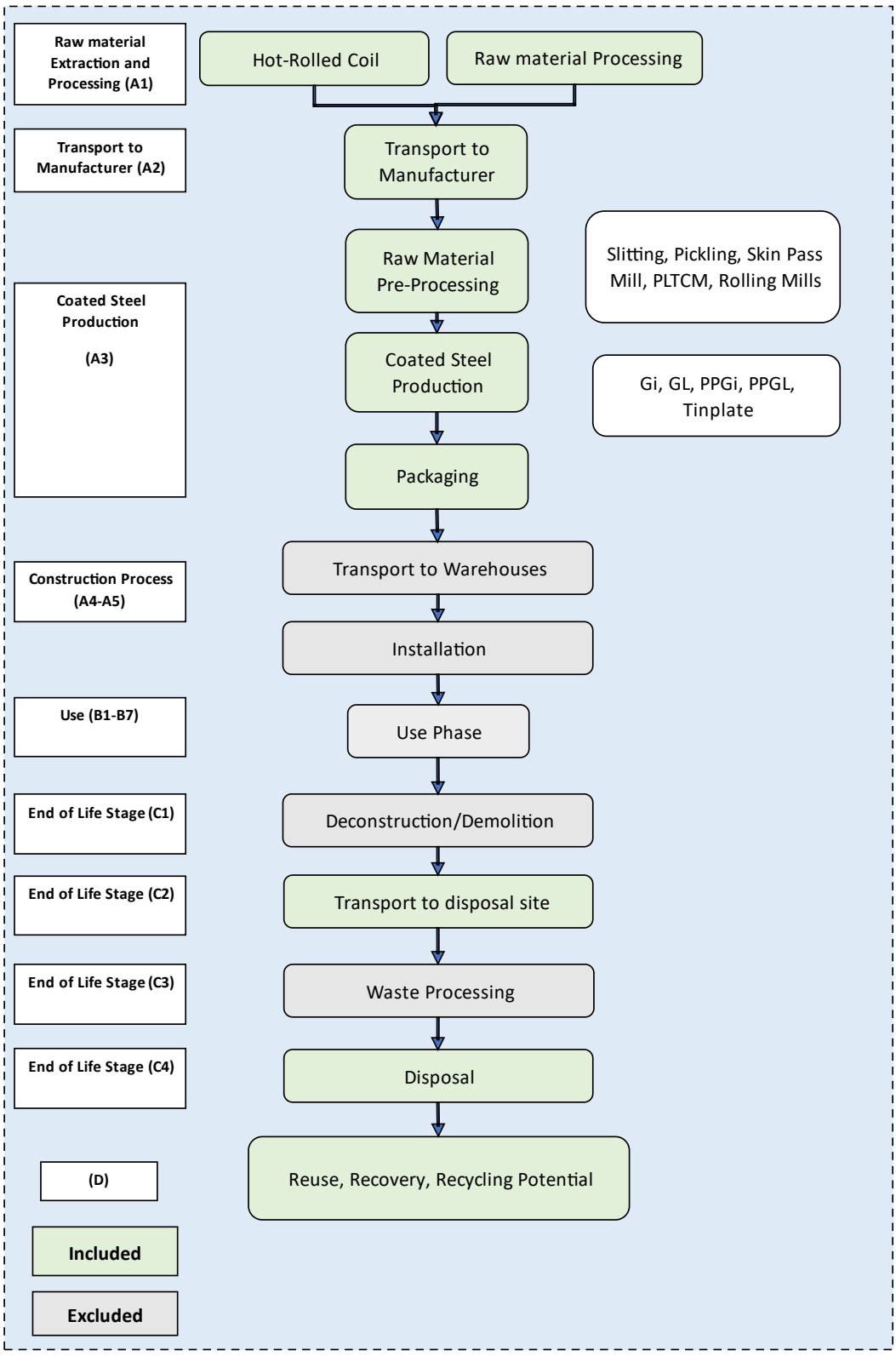


Figure 1: System Boundary (Schematic)

3.3 Process Description

Located just 25 kilometres away from Nagpur, the Kalmeshwar Plant is spread over a massive 3,44,344 sq. m., which makes it one of the biggest industries in the MIDC area. While taking over its reins in 2010, the goal was clear - to increase the product portfolio and reach a larger client base through our state-of-the-art facilities.

Kalmeshwar easily supplies its products to customers across the country. They've brought in cutting-edge Japanese technology in order to manufacture the best here. The Nippon Denro, for instance, has helped them to create a continuous pickling line. They also house two high cold reversing mills, one supported by Hitachi, and the other, homegrown. Innovation has always been at the heart of everything, and it helps them to stay one step ahead, both in terms of technology and production.

Products are manufactured using multiple Processes. JSW's Vijayanagar, Dolvi and other Plants provides the Hot-Rolled Coil (HRC) Steel to manufacturing site for further processing. This HRC is firstly taken into slitting and pickling process where, cutting of sheets as per desired dimensions and removal of impurities takes place. After that, fraction of output generated from pickling process is sent to skin pass mill and some percentage share of that, is sent into three rolling mills where, improvement in surface texturing, surface flatness and mechanical properties takes place. Then the cold rolled coils are being sent for Galvanizing processes to produce Galvalume. Further, this product is sent for Packaging.

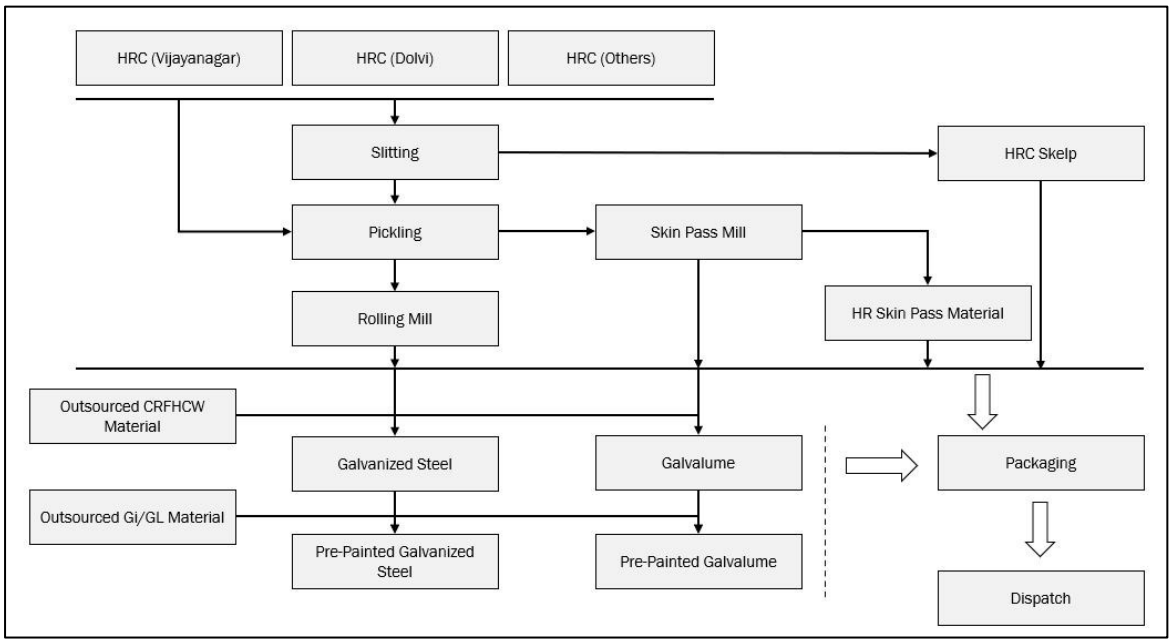


Figure 2: Manufacturing Process at Kalmeshwar

4. LCA

4.1 Information Sources and Data Quality

It is important that data quality is in accordance with the requirements of the LCA's goal and scope. This is essential to the reliability of LCA and achievement of the intended application. 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 collection questionnaires was used for the study and for upstream processes GaBi 10.6 Modelling database 2021 was used.

4.2 Methodological Details

4.2.1 Declared unit

The declared unit for the EPD is 1 tonne of Galvalume product manufactured at JSW Steel Coated Products Limited (JSWSCPL), Kalmeshwar Plant, India.

4.2.2 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 EN15804+A2:2019 (Table 6), and divided into Production, Installation, Use stage, End-of-Life module and Credits & charges outside system boundary (if included).

Table 6: Environmental impacts indicators for EN15804+A2:2019

Impact category	Indicator	Unit
Climate change – total	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	Acidification potential, Accumulated Exceedance (AP)	Mole of H+ eq.
Eutrophication aquatic freshwater	Eutrophication potential, fraction of nutrients reaching freshwater end compartment (EP-freshwater)	kg P eq.
Eutrophication aquatic 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	Formation potential of tropospheric ozone (POCP)	kg NMVOC eq.
Depletion of abiotic resources - minerals and metals[2]	Abiotic depletion potential for non-fossil resources (ADP- minerals & metals)	kg Sb eq.
Depletion of abiotic resources - fossil fuels[2]	Abiotic depletion for fossil resources potential (ADP-fossil)	MJ
Water use[2]	Water (user) deprivation potential, deprivation-weighted water consumption (WDP)	m^3 world eq.

The consumption of natural resources per declared or function unit is reported in the EPD. Input parameters, according with EN15804+A2, describing resource use are shown in Table 7.

Table 7.Natural resources use parameters

Parameter	Unit
Renewable primary energy as energy carrier (PERE)	MJ
Renewable primary energy resources as material utilization (PERM)	MJ
Total use of renewable primary energy resources (PERT)	MJ
Non-renewable primary energy as energy carrier (PENRE)	MJ
Non-renewable primary energy as material utilization (PENRM)	MJ
Total use of non-renewable primary energy resources (PENRT)	MJ
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

Table 8. Output flows and waste categories parameters

Parameter	Unit
Hazardous waste disposed (HWD)	kg
Non-hazardous waste disposed (NHWD)	kg
Radioactive waste disposed (RWD)	kg
Components for re-use (CRU)	kg
Materials for recycling (MFR)	kg
Materials for energy recovery (MER)	kg
Exported electrical energy (EEE)	MJ
Exported thermal energy (EET)	MJ

Table 9. Additional parameters

Impact category	Indicator	Unit
Particulate matter emissions	Potential incidence of disease due to PM emissions (PM)	Disease incidences
Ionising radiation[1]	Potential Human exposure efficiency relative to U235 (IRP)	kBq U235 eq.
Eco-toxicity (freshwater)[2]	Potential Comparative Toxic Unit for ecosystems (ETP - fw)	CTUe
Human toxicity, cancer effects[2]	Potential Comparative Toxic Unit for humans (HTP - c)	CTUh
Human toxicity, non-cancer effects[2]	Potential Comparative Toxic Unit for humans (HTP - nc)	CTUh
Land use related impacts/ Soil quality potential[2]	Potential soil quality index (SQP)	Pt

**Disclaimer 1 – This impact category deals mainly with the eventual impact of low dose ionizing radiation on human health of the nuclear fuel cycle. It does not consider effects due to possible nuclear accidents, occupational exposure nor due to radioactive waste disposal in underground facilities. Potential ionizing radiation from the soil, from radon and from some construction materials is also not measured by this indicator.*

**Disclaimer 2 – The results of this environmental impact indicator shall be used with care as the uncertainties on these results are high or as there is limited experienced with the indicator.*

4.2.3 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 and electricity.

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.

4.3 Co-Product Allocation

With any multi-product system, allocation rules are defined to relate the system inputs and outputs to each of the products. Several methods are documented in ISO 14040:2006 and ISO Technical Report 14049. The inventory for this product was provided so the allocation/apportion was not applied in terms of mass or production volume for any data points. However, the mass allocation has been applied as follows for the sub processes:

Table 10: Allocation Applied

Unit Name - Kalmeshwar		
Process Name	**Product**	**Percentage of Allocation**
Slitting	Slitted HRC	95.5%
	HR Skelp via Slitting	4.46%
Skin Pass Mill	HRC	97.9%
	HR Skin pass Mill	2.14%

4.4 System Boundaries

The study covers the stages from production of raw materials to the End of Life of the product, excluding the use phase of the product.

The scope covers the ecological information to be divided into raw material production (A1), inbound transportation (A2), Manufacturing (A3), treatment of packaging (A5), transport of dismantled product to EoL site (C2), waste processing (C3), disposal (C4)as well as the end of life stage recycling (D) considerations.

4.4.1 Geographic System Boundaries

The geographical coverage of this study covers the production of galvalume product at JSW Steel Coated Products Limited (JSWSCPL), Kalmeshwar plant in India. Indian specific datasets wherever possible have been adapted and others dataset were chosen from EU if no Indian datasets were available. In addition, imported raw materials are considered along with transport. All the primary data has been collected from JSW Steel Coated Products Limited (JSWSCPL) in cooperation with experts from Sphera (formerly Thinkstep AG).

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 for the FY April 2021 – March 2022. It is believed to be representative of steel production during this time frame.

4.4.3 Technology coverage

In the present study, Hot-Rolled Coil, Cold rolled Coil steel is the major raw material used in the production of the Galvalume.

4.5 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. Accounting for all these, the End-of-life credit for recycling is applied over 85% of steel (850 kg in 1 ton of steel products).[2] The landfill is considered as 15% of steel (150 kg in 1 ton of steel products).

4.6 Software and database

The LCA model was created using the GaBi 10.6.0.110 Software system for life cycle engineering, developed by Sphera Solutions Inc. The GaBi database provides the life cycle inventory data for several of the raw and process materials obtained from the upstream system. Detailed database documentation for GaBi datasets can be accessed at:

https://sphera.com/product-sustainability-gabi-data-search/

4.7 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.

[2] http://www.worldsteel.org/en/dam/jcr:6a222ba2-e35a-4126-83ab-5ae5a79e6e46/LCA+Methodology+Report.pdf

4.8 Results

Modules of the life cycle included as per PCR is given in Table 11.

Table 11. Modules of the production life cycle included (X = declared module; MND = module not declared)

	Production			Installation		Use stage							End-of-Life				Credits & charges outside system boundary
	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
Module	A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
Modules declared	X	X	X	MND	X	MND	MND	MND	MND	MND	MND	MND	X	X	X	X	X
Geography	India																
Specific data used				-	-	-	-	-	-	-	-	-	-	-	-	-	-
Variation - products	NA																
Variation – Sites	NA																

4.8.1 LCIA results for 1 tonne of Galvalume Steel Product

The LCIA results for 1 tonne of Galvalume Steel are given in Table 12 - Table 17.

Table 12: Environmental impacts for 1 tonne of Galvalume Steel

1. Environmental impact indicators							
Parameters	A1-A3	A5	C1	C2	C3	C4	D
Climate Change - total [kg CO_2 eq.]	3.59E+03	9.09E-01	0.00E+00	3.25E+00	0.00E+00	2.28E+00	-1.45E+03
Climate Change, fossil [kg CO_2 eq.]	3.58E+03	7.27E-01	0.00E+00	3.24E+00	0.00E+00	2.27E+00	-1.45E+03
Climate Change, biogenic [kg CO_2 eq.]	1.10E-01	1.81E-01	0.00E+00	8.07E-03	0.00E+00	7.98E-03	-8.22E-01
Climate Change, land use and land use change [kg CO_2 eq.]	2.30E+00	3.07E-05	0.00E+00	1.69E-04	0.00E+00	6.66E-03	-3.28E-02
Ozone depletion [kg CFC-11 eq.]	1.22E-06	2.58E-16	0.00E+00	2.66E-16	0.00E+00	8.81E-15	-3.44E-12
Acidification [Mole of H+ eq.]	2.86E+01	1.44E-04	0.00E+00	1.93E-02	0.00E+00	1.62E-02	-2.58E+00
Eutrophication, freshwater [kg P eq.]	1.16E-03	4.08E-08	0.00E+00	6.86E-07	0.00E+00	3.81E-06	-3.14E-04
Eutrophication, marine [kg N eq.]	4.16E+00	4.39E-05	0.00E+00	8.68E-03	0.00E+00	4.19E-03	-4.97E-01
Eutrophication, terrestrial [Mole of N eq.]	4.56E+01	6.54E-04	0.00E+00	9.52E-02	0.00E+00	4.61E-02	-5.03E+00
Photochemical ozone formation, human health [kg NMVOC eq.]	1.22E+01	1.22E-04	0.00E+00	1.72E-02	0.00E+00	1.27E-02	-2.22E+00
Resource use, mineral and metals [kg Sb eq.]	9.94E-02	3.76E-09	0.00E+00	4.28E-08	0.00E+00	2.14E-07	-3.58E-03
Resource use, fossils [MJ]	3.67E+04	3.41E-01	0.00E+00	4.30E+01	0.00E+00	3.01E+01	-1.41E+04
Water use [m^3 world equiv.]	2.85E+02	9.82E-02	0.00E+00	9.79E-03	0.00E+00	2.43E-01	-3.93E+03

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); GWP – GHG = global warming potential (greenhouse gases); 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.

Table 13: Environmental impacts (GWP) for 1 tonne of Galvalume Steel

Parameters	A1-A3	A5	C1	C2	C3	C4	D
GWP-GHG*	3.53E+03	7.26E-01	0.00E+00	3.19E+00	0.00E+00	2.23E+00	-1.39E+03
**This indicator includes all greenhouse gases included in GWP-total but excludes biogenic carbon dioxide emissions and uptake and biogenic carbon stored in the product with characterization factors (CFs) based on IPCC (2013);*							

Table 14: Resource use indicators for 1 tonne of Galvalume Steel

2. Resource use indicators							
Parameters	A1-A3	A5	C1	C2	C3	C4	D
Use of renewable primary energy (PERE) [MJ]	2.10E+03	2.28E+00	0.00E+00	1.84E-01	0.00E+00	4.05E+00	8.88E+02
Primary energy resources used as raw materials (PERM) [MJ]	2.21E+00	-2.21E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Total use of renewable primary energy resources (PERT) [MJ]	2.10E+03	7.24E-02	0.00E+00	1.84E-01	0.00E+00	4.05E+00	8.88E+02
Use of non-renewable primary energy (PENRE) [MJ]	3.67E+04	1.28E+01	0.00E+00	4.30E+01	0.00E+00	3.01E+01	-1.41E+04
Non-renewable primary energy resources used as raw material (PENRM) [MJ]	1.24E+01	-1.24E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Total use of non-renewable primary energy resources (PENRT)	3.67E+04	3.41E-01	0.00E+00	4.30E+01	0.00E+00	3.01E+01	-1.41E+04
Use of renewable secondary fuels (RSF) [MJ]	3.93E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Use of non-renewable secondary fuels (NRSF) [MJ]	5.99E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Use of net fresh water (FW) [m3]	8.76E+00	2.33E-03	0.00E+00	3.37E-04	0.00E+00	7.43E-03	-9.19E+01
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 15: Output flows and waste categories for 1 tonne of Galvalume

3. Output flows and waste categories							
Parameters	A1-A3	A5	C1	C2	C3	C4	D
Hazardous waste disposed (HWD) [kg]	4.97E-06	6.15E-11	0.00E+00	1.98E-10	0.00E+00	3.20E-09	3.09E-06
Non-hazardous waste disposed (NHWD) [kg]	1.93E+02	7.56E-02	0.00E+00	7.74E-04	0.00E+00	1.50E+02	1.80E+02
Radioactive waste disposed (RWD) [kg]	1.51E-01	1.40E-05	0.00E+00	9.34E-06	0.00E+00	3.15E-04	1.46E-03
Materials for Recycling (MFR) [kg]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.50E+02	0.00E+00	0.00E+00
Materials for energy recovery (MER) [kg]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Exported electrical energy (EEE) [MJ]	0.00E+00	1.88E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Exported thermal energy (EET) [MJ]	0.00E+00	3.39E+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; CRU = Components for re-use, MFR = Materials for recycling; MER = Materials for energy recovery; EEE = Exported electrical energy; EET = Exported thermal energy							

Table 16: Biogenic carbon content of product and packaging for 1 tonne of Galvalume

4. Biogenic carbon content							
Parameters	A1-A3	A5	C1	C2	C3	C4	D
Biogenic carbon content in product [kg]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Biogenic carbon content in packaging [kg]	5.59E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

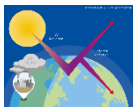
Table 17: Additional Environmental parameters for 1 tonne of Galvalume

5. Optional indicators							
Parameters	A1-A3	A5	C1	C2	C3	C4	D
Particulate matter [Disease incidences]	4.50E-04	1.59E-09	0.00E+00	7.88E-08	0.00E+00	2.01E-07	-4.91E-05
Ionising radiation, human health [kBq U235	1.05E+01	1.91E-03	0.00E+00	8.74E-04	0.00E+00	3.31E-02	2.66E+01
Ecotoxicity, freshwater [CTUe]	4.65E+03	2.29E-01	0.00E+00	1.69E+01	0.00E+00	1.73E+01	-9.14E+02
Human toxicity, cancer [CTUh]	3.17E-07	1.25E-11	0.00E+00	2.87E-10	0.00E+00	2.53E-09	-7.84E-07
Human toxicity, non-cancer [CTUh]	1.84E-05	1.25E-09	0.00E+00	1.17E-08	0.00E+00	2.79E-07	-1.74E-05
Land Use [Pt]	2.03E+03	8.40E-02	0.00E+00	1.86E-01	0.00E+00	6.08E+00	2.10E+02
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							

4.9 Interpretation

The interpretation of the results for 1 tonne of Galvalume Steel Product are presented in Table 18.

Table 18: Interpretation of most significant contributors to life cycle parameters (Galvalume Steel)

Parameter		Most significant contributor
Abiotic Depletion Potential (ADP) - Elements		The total cradle to gate impact is 9.94E-02 kg Sb eq. In A1 – A3 module more than 99% impact is coming from Galvanizing shop (due to the zinc). A total credit of 3.58E-03 kg Sb eq. is taken in module D.
Acidification Potential (AP)		The total cradle to gate impact is 28.62 Mole of H+ eq. In A1 – A3, major impact is coming from HRC (63.07%), followed by Galvanizing shop (26.2%) (due to aluminium (70.7%) and electricity (17.4%)). A total credit of 2.58E+00 Mole of H+ eq. is taken in module D.
Eutrophication Potential (EP)		The total cradle to gate impact is 1.16E-03 kg P eq. In A1 – A3, major impact is coming from HRC (67.13%), followed by Galvanizing shop (20.8%) (due to aluminium (68.9%), Electricity (17%) and zinc (9.18%)). A total credit of 3.14E-04 kg P eq. is taken in module D.
Climate Change - total [kg CO_2 eq.]		The total cradle to gate impact is 3.59E+03 kg CO_2 eq. In A1 – A3, major impact is coming from HRC (68.1%), followed by Galvanizing shop (17.9%) (due to aluminium (68%), electricity (15.2%)). A total credit of 1.45E+03 kg CO_2 eq. is taken in the module D.
Ozone Layer Depletion Potential (ODP, steady state)		The total cradle to gate impact is 1.22E-06 kg CFC-11 eq. In module A1 – A3, major impact is coming from HRC (100%). A total credit of 3.44E-12 kg CFC-11 eq. is taken in module D.
Photochemical Ozone Creation Potential (POCP)		The total cradle to gate impact is 1.22E+01 kg NMVOC eq. In module A1 – A3, major impact is coming from HRC (65.06%), followed by galvanizing shop (26.8%) (due to aluminium (68.2%) and electricity (16.6%). A total credit of 2.22E+00 kg NMVOC eq. is taken in module D.
Abiotic depletion potential (ADP) - Fossil		The total cradle to gate impact is 3.67E+04 MJ. In A1- A3 module, major impact is coming from HRC (65.43%), followed by Galvanizing shop (18.4%) (due aluminium (64.1%), electricity (14.8%)). A total credit of 1.41E+04 MJ is taken in module D.

Concluding, the study provides fair understanding of environmental impacts during the various life cycle stages of 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 (A1), transportation (A2), Manufacturing (A3), treatment of packaging (A5), transport of dismantled product to EoL site (C2), waste processing (C3), waste disposal (C4)as well as the end of life stage recycling (D) considerations.

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 2021: Dokumentation der GaBi-Datensätze der Datenbank zur Ganzheitlichen Bilanzierung. LBP, Universität Stuttgart und PE International, 2012
- GaBi 10 2021: Software und Datenbank zur Ganzheitlichen Bilanzierung. LBP, Universität Stuttgart und PE International, 2012
- 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.
- ISO/TR 14049:2012 Environmental management — Life cycle assessment — Illustrative examples on how to apply ISO 14044 to goal and scope definition and inventory analysis.
- WSI and Eurofer's Co-product Allocation Methodology 2014 - A methodology to determine the LCI of Steel industry Co-products.
- World Steel Association - CO_2 Data Collection User Guide, Version 9 (May 2019.
- PCR 2019:14, Product Category Rules (PCR) for 'CONSTRUCTION PRODUCT' Version 1.2.5.