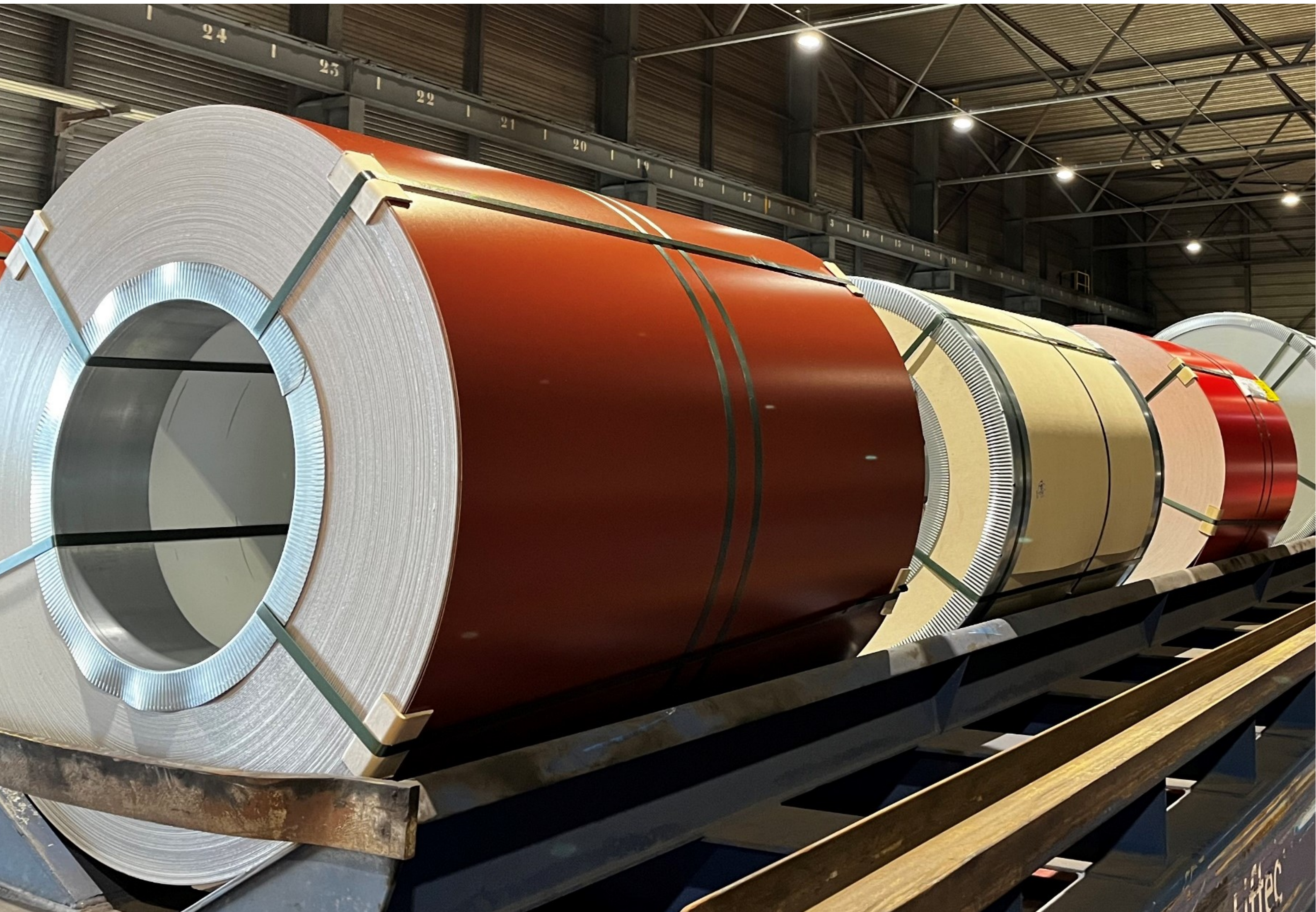
Lower Carbon Embodied Organic Coated Steel from Maubeuge on EAF substrate

Environmental Product Declaration



CONTENTS

Organic Coated Steel
Environmental Product Declaration
(in accordance with ISO 14025 and EN 15804)

This EPD is representative and valid for the specified (named) product.

Declaration Number: EPD-TS-2024-994
Date of Issue: 22nd October 2024
Valid until: 21st October 2025

Owner of the Declaration: Tata Steel Netherlands
Programme Operator: Tata Steel UK Limited, 18 Grosvenor Place, London, SW1X 7HS

The CEN standard EN 15804:2012+A2:2019 serves as the core Product Category Rules (PCR) supported by Tata Steel's EN 15804 verified EPD PCR documents

Independent verification of the declaration and data, according to ISO 14025

Internal ☐ External ☒

Author of the Life Cycle Assessment: Tata Steel Netherlands
Third party verifier: Chris Foster, Eugeos Ltd.

1 General information

Owner of EPD	Tata Steel Netherlands
Product	Organic coated coil (Colorcoat® and Advantica® pre-finished steel coil) with Electric Arc Furnace (EAF) substrate
Manufacturer	Tata Steel Netherlands
Manufacturing sites	Maubeuge
Product applications	Building Envelope (product brand name Colorcoat®) and Manufactured Goods (product brand name Advantica®)
Declared unit	1 tonne of steel product
Date of issue	22nd October 2024
Valid until	21st October 2025

EPD
THIRD PARTY VERIFIED ISO 14025 & EN 15804

This Environmental Product Declaration (EPD) is for organic coated steel made with externally purchased EAF substrate, manufactured by Tata Steel Netherlands. The environmental indicators are average values for organic coated steel from Maubeuge.

The information in this Environmental Product Declaration is based on production data from 2021.

EN 15804 serves as the core PCR, supported by Tata Steel's EN 15804 verified EPD programme Product Category Rules documents, and this declaration has been independently verified according to ISO 14025 [1,2,3,4,5,6,7].

Third party verifier

Chris Foster, Eugeos SRL, rue Dieudonné Lefèvre 17,
B-1020 Brussels, Belgium

2 Product information

2.1 Product description

This EPD is valid for Tata Steel Netherlands' organic coated steel products from Maubeuge, made with externally purchased EAF steel and sold under the brands of Colorcoat® and Advantica®.

Colorcoat® is a range of pre-finished steel products for building envelope, roof and wall cladding systems. These are used in a wide range of industrial and commercial buildings, including warehousing, distribution and logistics, as well as schools, offices, retail, leisure and residential applications.

Advantica® is a range of pre-finished steel products specifically formulated for manufactured goods and widely used amongst others for the following applications, amongst others: controlled environments, doors and windows, lighting, ceilings, heating and ventilation, office furniture, transportation industry.

All Colorcoat® and Advantica® products are covered by this EPD, including:

- Colorcoat® SDP 50
- Colorcoat® SDP 35
- Colorcoat® PE 25
- Colorcoat® PE 15
- Colorcoat® PVDF
- Advantica® L Control

The results presented in this EPD are average values for these products manufactured at Maubeuge.

2.2 Manufacturing

The manufacturing sites included in the EPD are listed in Table 1 below. For this specific product, Maubeuge takes primary EAF steel from external sources.

Table 1 Participating sites

Site name	Product	Manufacturer	Country
Maubeuge	Pre-finished steel	Tata Steel	FR

The process of Electric Arc Furnace (EAF) steel uses electricity to melt steel scrap and refined iron sources. Iron ore is reduced with natural gas and be used directly as Direct Reduced Iron (DRI), or in a briquetted form as Hot Briquetted Iron (HBI). These raw materials are combined in an electric oven in order to create a steel melt, which is subsequently cast into slabs and rolled into coils to create hot rolled coil.

The hot rolled coil is supplied to Maubeuge by boat and truck, and these coils are pickled (to remove the oxide layer) and cold rolled (for further thickness reduction) before being processed on a combined galvanising and organic coating line.

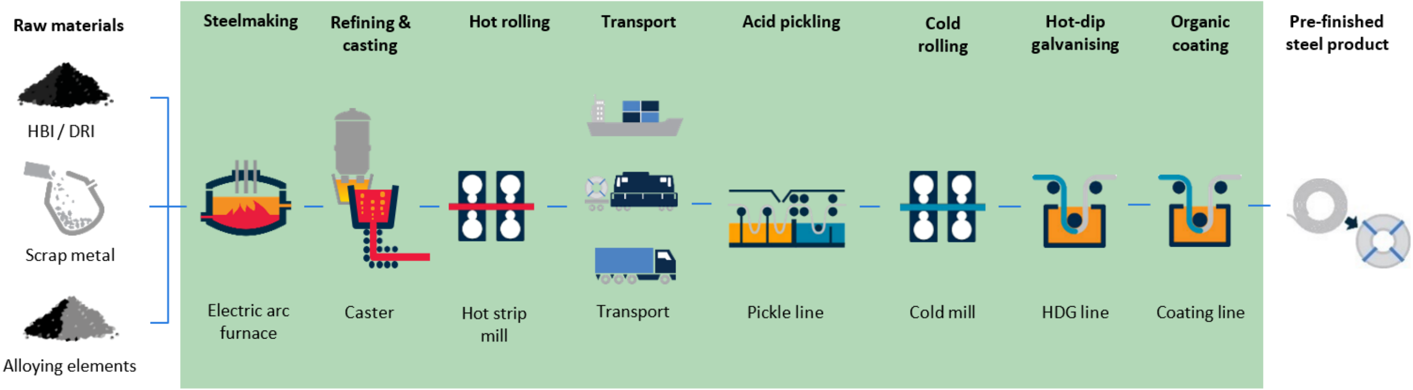
Pre-finished steel comprises a number of paint layers and treatments applied to steel in an automated and carefully controlled process with each layer of the product having a particular function. It is the combined effect of all these layers that give the product its overall performance and ensures a material that is robust and offers the specifier a choice of colour and effect.

During the organic coating process for pre-finished steel, a metallic coating is first applied to the steel coil. A pre-treatment is applied and then a primer before adding the final top coat layer in the form of liquid paint. For the vast majority of pre-finished steel products, the topcoats are applied on the front surface only, while the reverse or back side of the strip is produced with a high performing backing coat. These are cured at elevated temperatures before being recoiled ready for shipping.

An example of the process is shown in Figure 1.

The data for externally sourced substrate was supplier specific in the form of LCIA results on an EPD [12]. Organic coating data were primary data collected at Tata Steel's manufacturing sites as part of the latest worldsteel collection (2021), supplemented with additional data for the coating lines, such as paint manufacturing data.

Figure 1 Generic process flow of pre-finished steel products



2.3 Technical data and specifications

The general properties of organic coated steel are shown in Table 2.

Table 2 Technical specification of organic coated steel

	Organic coated steel
Metallic coating	All pre-finished steel is supplied with a zinc based metallic coating that conforms to EN 10346:2015 [8]
Paint coating (organic)	All pre-finished steel is fully REACH [9] compliant and chromate free
Certification	Certification applicable to Tata Steel's Maubeuge site are: ISO 9001 [10], ISO 14001 [11]

2.4 Packaging

The pre-finished coils are secured with plastic strapping, and additional steel, cardboard and plastic packaging is used to protect them during delivery to customer. The coils are transported on wooden pallets.

2.5 Reference service life

A reference service life for organic coated steel is not declared because the material can be used in a variety of different forms of construction, and the final construction application is not defined. To determine the full service life of organic coated steel, all factors would need to be included such as location and environment, corrosion protection, and fire protection. Corrosion and fire protection are usually applied during installation on site.

Pre-finished steels can be recovered and re-used or recycled repeatedly without loss of quality and they comply with the requirements of construction product class A1 (non-combustible).

2.6 Biogenic carbon content

There are no biogenic carbon containing materials in the product. The biogenic carbon content of the packaging materials is shown in Table 3.

Table 3 Biogenic carbon content at the factory gate

	kg C/t OCS
Biogenic carbon content (product)	0
Biogenic carbon content (packaging)	2,67

Note: 1 kg biogenic carbon is equivalent to 44/12 kg of CO_2

3 LCA methodology

3.1 Declared unit

The unit being declared is 1 tonne of pre-finished steel.

3.2 Scope

This EPD can be regarded as cradle-to-gate with modules C and D and the specific modules considered in the LCA are;

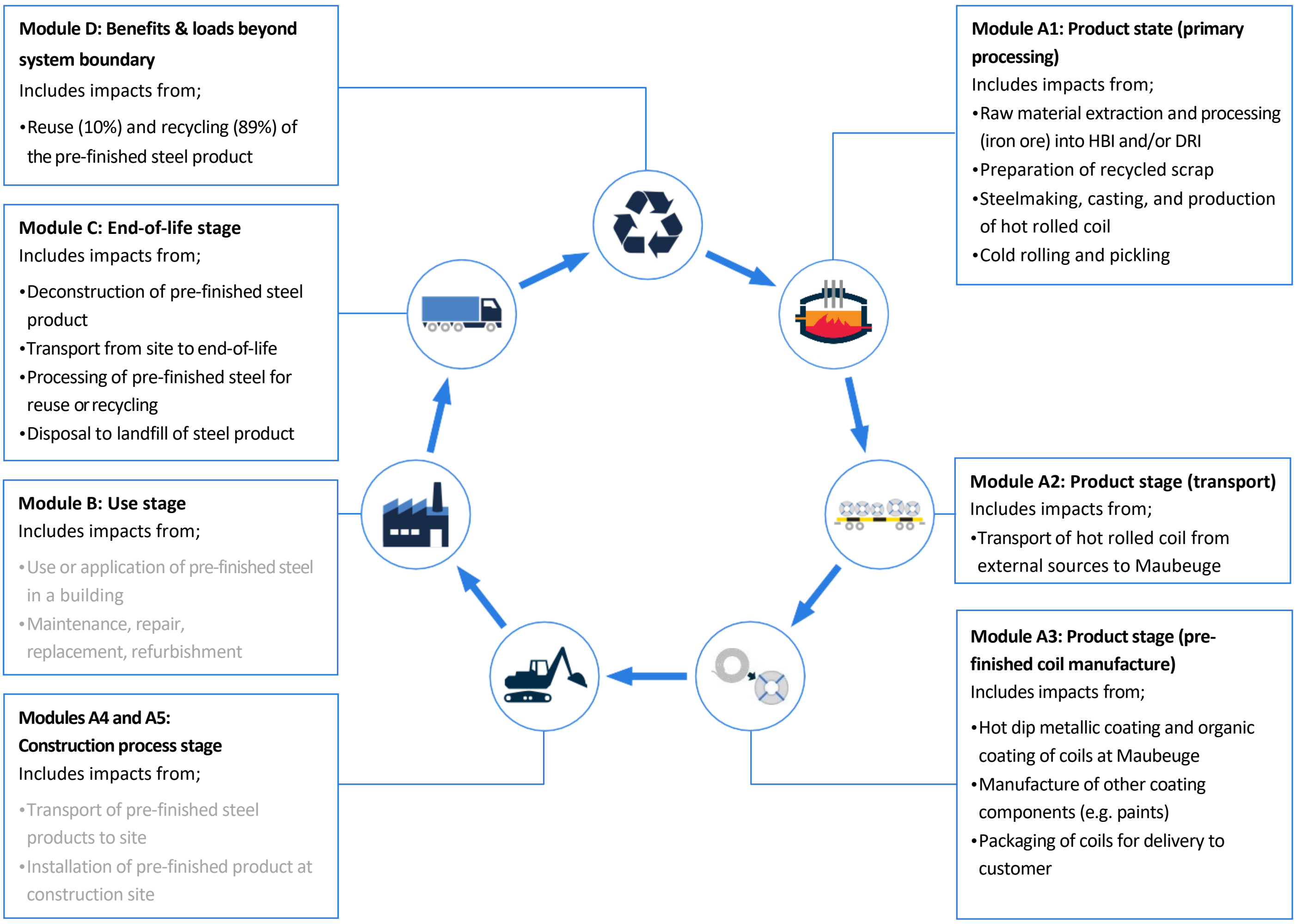
- A1-A3: Production stage (raw material supply, transport to production site, manufacturing)
- C1-C4: End-of-life (demolition/deconstruction, transport, processing for recycling and disposal)
- D: Reuse, recycling and recovery

The life cycle stages are explained in more detail in Figure 2, but where the text is in light grey, the impacts from this part of the life cycle are not considered.

3.3 Cut-off criteria

All information from the data collection process has been considered, covering all used and registered materials, and all fuel and energy consumption. On-site emissions were measured and those emissions have been considered. Data for all relevant sites were thoroughly checked and also cross-checked with one another to identify potential data gaps. No processes, materials or emissions that are known to make a significant contribution to the environmental impact of organic coated steel have been omitted. On this basis, there is no evidence to suggest that inputs or outputs contributing more than 1% to the overall mass or energy of the system, or that are environmentally significant, have been omitted. It is estimated that the sum of any excluded flows contribute less than 5% to the impact assessment categories. The manufacturing of required machinery and other infrastructure is not considered in the LCA.

Figure 2 Life Cycle Assessment of pre-finished steel coil



3.4 Background data

This EPD combines the results of a third-party EPD with primary data from Tata Steel's manufacturing process. Care must therefore be taken when comparing the results and potential differences in methodologies applied must be highlighted. The sections below address the extent of harmonisation and discuss any methodological (in)consistencies.

A primary requirement is that the third-party environmental data are produced according to the same standard as the current document. Both EPDs are produced in accordance with EN15804:2012+A2, ensuring a large extent of harmonisation in calculation rules.

For life cycle modelling of both the steel substrate and the organic coating process, Sphera's LCA for Experts is used [13]. The LCAfE database contains consistent and documented datasets that can be viewed in the online documentation [14]. The basic data from the LCAfE database were used for energy, transportation and auxiliary materials, both in the substrate supplier EPD and in the coating process model.

Specific data derived from Tata Steel's own production processes at Maubeuge were the first choice to use where available. Data was also obtained directly from relevant suppliers, such as for the steel substrate and the paint which is used in the coating process. These were supplied in both EPD format (steel substrate) and as LCI processes in the LCAfE software (paints and coatings).

3.5 Data quality

The EPD on which a large part of the A1-A3 data is based is produced using manufacturing data from 2021. These data were verified by UK CARES and the quality is considered to be good [12].

The data from Tata Steel's own production processes are from 2021, and the technologies on which these processes were based during that period, are those used at the date of publication of this EPD. Data validation and verification was performed internally as well as by worldsteel.

All relevant background datasets are taken from the LCAfE software database, with the last revision of these datasets taking place less than 10 years ago. There are some small exceptions of background data where a recent database figure was not available (EoL shredding process data and PVDF production). In addition, some modelling was performed for materials where data was not available (e.g. some pre-treatment chemicals). It is estimated that these flows account for <0,5% of environmental impacts across all categories.

An assessment of the quality of data used in this study has been made using the scheme provided in the UN Environment Global Guidance on LCA database development, referenced in EN 15804. The study is considered to be based on good quality data.

3.6 Allocation

Allocation is applied to the co-production of EAF slag and mill scales in the steel manufacturing process [12]. This is done based on economic value, with a relative revenue of 0,02% and 0,24% respectively. It must be noted that this is allowed by EN15804, but not harmonised with the Tata Steels' other EPDs, which apply the EUROFER/worldsteel methodology of physical partitioning[15].

End-of-life assumptions for recovered steel and steel recycling are accounted for as per the current methodology from the World Steel Association 2017 Life Cycle Assessment methodology report [16]. A net scrap approach is used to avoid double accounting, and the net impacts are reported as benefits and loads beyond the system boundary (module D).

3.7 Additional technical information

The main scenario assumptions used in the LCA are detailed in Table 4. The end-of-life percentages are taken from a Tata Steel/EUROFER recycling and re-use survey of UK demolition contractors carried out in 2012 [17].

For all indicators the characterisation factors from the EC-JRC are applied, identified by the name EN_15804, and based upon the EF Reference Package 3.1 [18]. In LCAfE, the corresponding impact assessment is used, denoted by 'EN 15804+A2'.

The values presented in the LCA results tables of section 4 are average values for organic coated steel manufactured at Maubeuge, comprising different coating types and thicknesses.

3.8 Comparability

Care must be taken when comparing EPDs from different sources. EPDs may not be comparable if they do not have the same functional unit or scope (for example, whether they include installation allowances in the building), or if they do not follow the same standard such as EN 15804. The use of different generic data sets for upstream or downstream processes that form part of the product system may also mean that EPDs are not comparable. Comparisons should ideally be integrated into a whole building/infrastructure assessment, in order to capture any differences in other aspects of the building or infrastructure design that may result from specifying different products. For example, a more durable product would require less maintenance and reduce the number of replacements and associated impacts over the life of the building or infrastructure, or, a higher strength product may require less material for the same function.

Table 4 Main scenario assumptions

Modu	Scenario assumptions
A1 to A3 – Product stage	Supplier-specific data (based on EN15804+A2) were used for the steel substrate [12]. Manufacturing data from Tata Steel's Maubeuge site were used for the coating process.
A2 – Transport to the manufacturing site	The pre-finished steel manufacturing facilities are located at Maubeuge. The steel substrate is transported mainly by ship with assumed utilisation factor of 50%. Part of these journeys are by road, and a 25 tonne capacity truck with 45% utilisation is assumed.
C1 – Deconstruction and demolition	Energy consumption estimated based upon published data for the dismantling of steel constructions in Germany [19].
C2 – Transport for recycling, reuse, and disposal	A transport distance of 100km to landfill or to a recycling site is assumed, while a distance of 250km is assumed for reuse. Transport is on a 25 tonne load capacity lorry with 20% utilisation to account for empty returns.
C3 – Waste processing for reuse, recovery and/or recycling	Steel that is recycled is processed in a shredder. There is no additional processing of material for reuse.
C4 - Disposal	At end-of-life, 1% of the steel is disposed in a landfill, in accordance with the findings of an NFDC survey [17].
D – Reuse, recycling, and energy recovery	At end-of-life, 89% of the steel is recycled and 10% is re-used, in accordance with the findings of an NFDC survey [17]. When reused, steel is assumed to require re-painting.

Please note that in the LCAfE software, an empty return journey is accounted for by halving the load capacity utilisation of the outbound journey.

4 Results of the LCA

Description of the system boundary

Product stage			Construction stage		Use stage							End-of-life stage				Benefits and loads beyond the system boundary
Raw material supply	Transport	Manufacturing	Transport	Installation	Use	Maintenance	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	De-construction demolition	Transport	Waste processing	Disposal	Reuse Recovery Recycling
A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
X	X	X	ND	ND	ND	ND	ND	ND	ND	ND	ND	X	X	X	X	X

X = Included in LCA; ND = module not declared

Environmental impact:

1 tonne of organic coated steel

Parameter	Unit	A1 – A3	C1	C2	C3	C4	D
GWP-total	kg CO_2 eq	1,88E+03	4,42E+01	8,22E+00	1,06E+01	7,60E+00	4,25E+01
GWP-fossil	kg CO_2 eq	1,88E+03	4,41E+01	8,26E+00	1,06E+01	1,48E-01	4,37E+01
GWP-biogenic	kg CO_2 eq	-7,27E+00	5,14E-02	-1,22E-01	-1,10E-01	7,45E+00	-1,19E+00
GWP-luluc	kg CO_2 eq	7,24E-01	9,32E-04	7,64E-02	5,11E-02	4,67E-04	-4,78E-03
ODP	kg CFC11 eq	9,11E-06	1,39E-11	7,22E-13	2,45E-10	3,82E-13	-3,16E-07
AP	mol H^+ eq	1,46E+01	5,74E-02	3,29E-02	3,47E-02	1,07E-03	1,09E-01
EP-freshwater	kg P eq	1,72E-02	2,27E-05	3,01E-05	3,74E-05	3,03E-07	-6,12E-04
EP-marine	kg N eq	2,80E+00	1,91E-02	1,55E-02	6,44E-03	2,75E-04	-2,55E-02
EP-terrestrial	mol N eq	3,00E+01	2,10E-01	1,73E-01	6,89E-02	3,03E-03	-4,83E-01
POCP	kg NMVOC eq	8,56E+00	6,28E-02	2,98E-02	1,85E-02	8,31E-04	-3,30E-02
ADP-minerals&metals	kg Sb eq	1,11E-01	5,43E-07	5,36E-07	3,88E-06	6,94E-09	-9,53E-03
ADP-fossil	MJ net calorific value	2,43E+04	6,16E+02	1,12E+02	2,18E+02	2,00E+00	3,24E+01
WDP	m^3 world eq deprived	1,17E+04	2,40E-01	9,51E-02	2,10E+00	1,65E-02	-3,54E+01
PM	Disease incidence	ND	ND	ND	ND	ND	ND
IRP	kBq U235 eq	ND	ND	ND	ND	ND	ND
ETP-fw	CTUe	ND	ND	ND	ND	ND	ND
HTP-c	CTUh	ND	ND	ND	ND	ND	ND
HTP-nc	CTUh	ND	ND	ND	ND	ND	ND
Land use	Pt	ND	ND	ND	ND	ND	ND

GWP-total	Global Warming Potential total
GWP-fossil	Global Warming Potential fossil fuels
GWP-biogenic	Global Warming Potential biogenic
GWP-luluc	Global Warming Potential land use land use change
ODP	Depletion potential of stratospheric ozone layer
AP	Acidification potential, Accumulated Exceedance
EP-freshwater	Eutrophication potential, fraction of nutrients reaching freshwater end compartment
EP-marine	Eutrophication potential, fraction of nutrients reaching marine end compartment
EP-terrestrial	Eutrophication potential, Accumulated Exceedance
POCP	Formation potential of tropospheric ozone
ADP-M&M	Abiotic depletion potential for non-fossil resources (minerals & metals)
ADP-F	Abiotic depletion potential for fossil resources
WDP	Water (user) deprivation potential, deprivation-weighted water consumption
PM	Potential incidence of disease due to PM emissions
IRP	Potential Human exposure efficiency relative to U235
ETP-fw	Potential Comparative Toxic Unit for ecosystems
HTP-c	Potential Comparative Toxic Unit for humans
HTP-nc	Potential Comparative Toxic Unit for humans

The following indicators should be used with care as the uncertainties on these results are high or as there is limited experience with the indicator: ADP-minerals&metals, ADP-fossil, and WDP.

Resource use:

1 tonne of organic coated steel

Parameter	Unit	A1 – A3	C1	C2	C3	C4	D
PERE	MJ	3,41E+03	9,78E+00	7,94E+00	6,23E+01	3,26E-01	-2,59E+02
PERM	MJ	3,40E+01	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
PERT	MJ	3,41E+03	9,78E+00	7,94E+00	6,23E+01	3,26E-01	-2,59E+02
PENRE	MJ	2,43E+04	6,17E+02	1,13E+02	2,18E+02	2,00E+00	3,20E+01
PENRM	MJ	4,35E+02	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
PENRT	MJ	2,43E+04	6,17E+02	1,13E+02	2,18E+02	2,00E+00	3,20E+01
SM	kg	-8,13E+02	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	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
FW	m^3	2,67E+02	1,00E-02	8,75E-03	8,96E-02	5,05E-04	2,59E+01

PERE Use of renewable primary energy excluding renewable primary energy resources used as raw materials
PERM Use of renewable primary energy resources used as raw materials
PERT Total use of renewable primary energy resources
PENRE Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials
PENRM Use of non-renewable primary energy resources used as raw materials
PENRT Total use of non-renewable primary energy resources
SM Input of secondary material
RSF Use of renewable secondary fuels
NRSF Use of non-renewable secondary fuels
FW Use of net fresh water

Output flows and waste categories:

1 tonne of organic coated steel

Parameter	Unit	A1 – A3	C1	C2	C3	C4	D
HWD	kg	3,38E+00	3,09E-09	4,16E-10	2,00E-06	4,36E-11	-2,58E-01
NHWD	kg	9,33E+01	1,34E-01	1,62E-02	1,20E-01	2,00E+01	-3,46E+01
RWD	kg	1,02E+00	2,59E-03	1,45E-04	2,76E-02	2,28E-05	-9,59E-02
CRU	kg	0,00E+00	0,00E+00	0,00E+00	1,00E+02	0,00E+00	0,00E+00
MFR	kg	2,53E+01	0,00E+00	0,00E+00	8,90E+02	0,00E+00	-2,04E+00
MER	kg	1,18E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	-7,52E-02
EEE	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

HWD Hazardous waste disposed
NHWD Non-hazardous waste disposed
RWD Radioactive waste disposed
CRU Components for reuse
MFR Materials for recycling
MER Materials for energy recovery
EEE Exported electrical energy
EET Exported thermal energy

5 Interpretation of results

Figure 3 shows the relative contribution per life cycle stage for selected environmental impact categories for 1 tonne of Tata Steel's organic coated steel product. Each column represents 100% of the total impact score, which is why all the columns have been set with the same length. A burden is shown as positive (above the 0% axis) and a benefit is shown as negative (below the 0% axis). The main contributors across the impact categories are A1-A3 (burdens) and D (benefits and loads beyond the system boundary).

Of the A1-A3 GWP impacts, the manufacturing of the steel substrate is responsible for approximately 73%; transport for 8%; and the coating processes (galvanising and coating) for approximately 19%. About two thirds of the impact of manufacturing impacts is caused by upstream raw material supply (HBI, DRI, pig iron); one third by energy use in the production process (steelmaking, casting and rolling). The coating impact mainly consists of emissions from energy use in the coating process as well as the impact of coating production (metallic as well as organic).

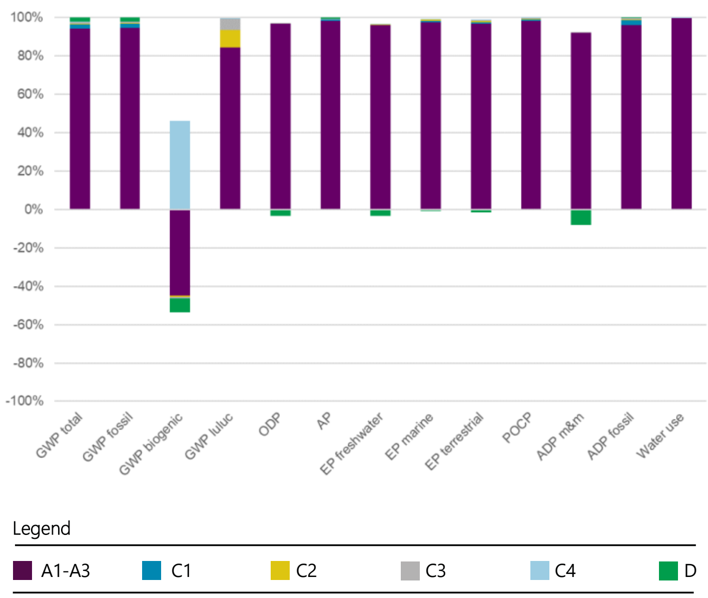
Substrate manufacturing is a significant source of impacts across most impact categories, with the exception of ODP, ADP M&M and EP (FW). These are nearly fully caused by the galvanising and coating stage (respectively through emissions of VOCs during paint manufacturing; the use of zinc during galvanising; and the phosphate emissions to water during paint manufacture). Transport is a significant contribution to the other EP impacts as well as AP.

Figure 3 clearly indicates the relatively small contribution to each impact from the other life cycle stages. The exceptions are the contribution of C4 (in which biogenic carbon from previous stages is assumed re-emitted) and module D, which has a small burden across several impact categories.

Module D values are largely derived using worldsteel's value of scrap methodology which is based upon many steel plants worldwide, including both BF/BOF and EAF steel production routes. At end-of-life, the recovered steel could modelled with a credit given as if it were re-melted in an Electric Arc Furnace [19]. However, due to application of the net scrap approach [16]. Module D represents a small burden in most impact categories due to the fact that at end-of-life, not enough material is made available for recycling to satisfy the scrap requirement of the production process in Module A1, and additional scrap has to be taken from outside the product system.

The specific emissions that represent the burden in A1-A3, are essentially the same as those responsible for this Module D impact. In the case of reuse of steel at end-of-life, the steel is assumed to be re-painted.

Figure 3 LCA results for organic coated steel



Referring to the LCA results, the impact in Module D for the Use of Renewable Primary Energy indicator (PERE and PERT) are both negative, in contrast to the other resource indicators. Renewable energy consumption is related to the use – and mix – of electricity (sources) in the "Value of scrap" process. So while for the other impact categories, due to the required net scrap input to the system, Module D presents a burden, the electricity mix used in the value of scrap produces more renewable energy and is therefore a credit or a net contributor in terms of renewable energy.

The values calculated in this EPD are based on an average of coating types and thicknesses. A sensitivity analysis of the results showed that for most impact indicators, including GWP, the variation between the products based on coating type was less than 5% (A1-A3).

6 References and product standards

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2. Tata Steel's EN 15804 verified EPD programme, Product Category Rules Part 1, V2 January 2022

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Language English UK 0624