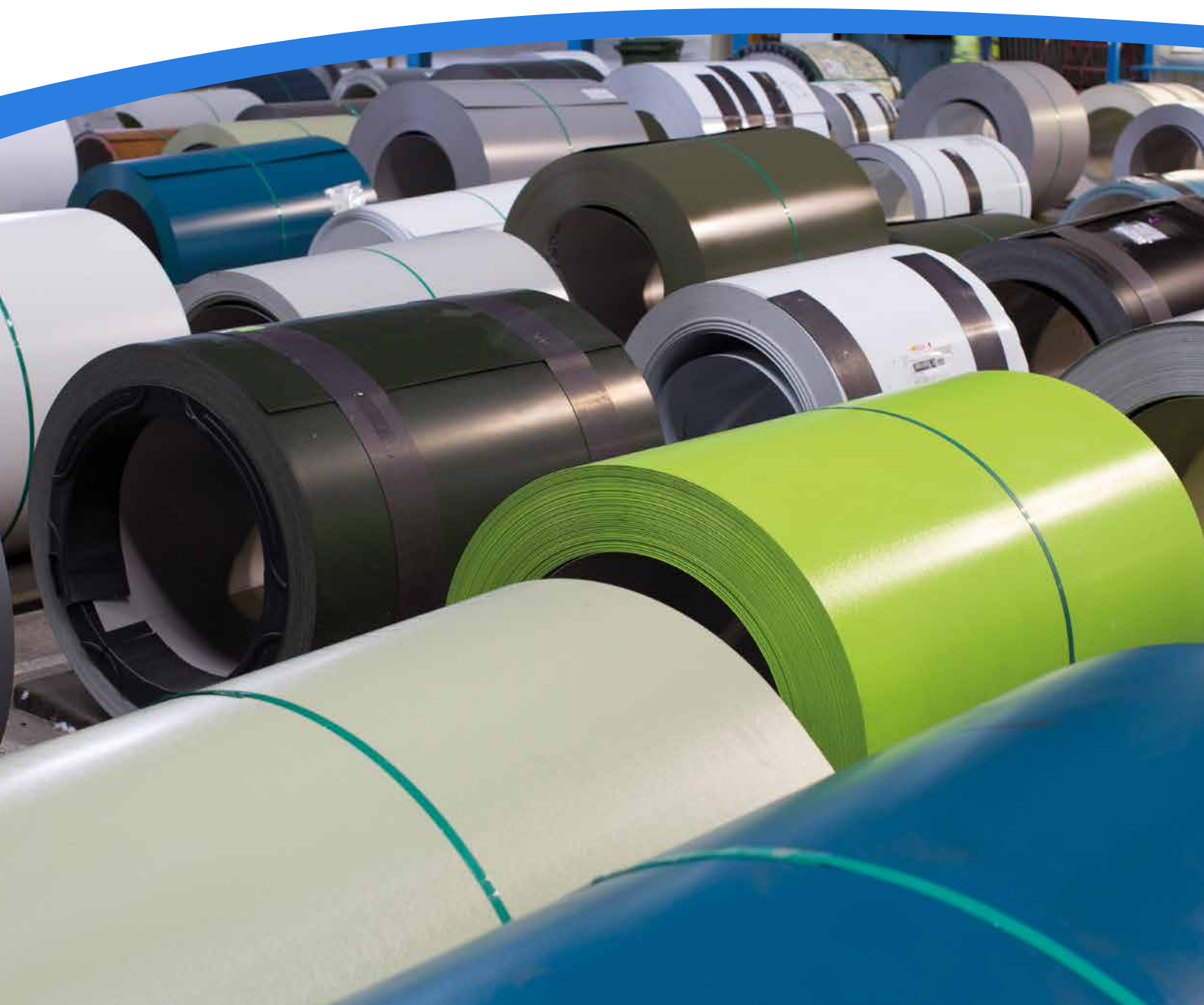


TATA STEEL



Colorcoat® pre-finished steel coil

Environmental Product Declaration



CONTENTS

1 General information	03
2 Product information	04
2.1 Product Description	04
2.2 Manufacturing	04
2.3 Technical data and specifications	06
2.4 Packaging	06
2.5 Reference service life	06
3 Life Cycle Assessment (LCA) methodology	07
3.1 Declared unit	07
3.2 Scope	07
3.3 Cut-off criteria	07
3.4 Background data	08
3.5 Data quality	08
3.6 Allocation	08
3.7 Additional technical information	09
3.8 Comparability	09
4 Results of the LCA	10
5 Interpretation of results	12
6 References and product standards	13

Colorcoat® pre-finished steel coil
Environmental Product Declaration
(in accordance with EN 15804 and ISO 14025)

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

Declaration Number: EPD-TS-2019-004
Date of Issue: 21st June 2019
Valid until: 20th June 2024

Owner of the Declaration: Tata Steel Europe
Programme Operator: Tata Steel UK Limited, 30 Millbank, London, SW1P 4WY

The CEN standard EN 15804:2012+A1:2013 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 14025:2010

Internal ☐ External ☒

Author of the Life Cycle Assessment: Tata Steel UK
Third party verifier: Olivier Muller, PricewaterhouseCoopers, Paris

1 General information

Owner of EPD	Tata Steel Europe
Product	Colorcoat® pre-finished steel coil
Manufacturer	Tata Steel Europe
Manufacturing sites	Port Talbot, Llanwern, Shotton, IJmuiden and Maubeuge
Product applications	Building Envelope (construction)
Declared unit	1 tonne of pre-finished steel coil
Date of issue	21st June 2019
Valid until	20th June 2024



This environmental product declaration is for Colorcoat® pre-finished steel manufactured by Tata Steel in Europe. The environmental indicators are for products manufactured at Shotton, IJmuiden and Maubeuge with feedstock supplied from Port Talbot, Llanwern and IJmuiden.

The information in the environmental product declaration is based on production data from 2013, 2016, and 2017.

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

Olivier Muller, PwC Stratégie - Développement Durable, PricewaterhouseCoopers Advisory,
63, rue de Villiers, 92208 Neuilly-sur-Seine, France

2 Product information

2.1 Product description

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.

The products covered by this EPD are;

- Colorcoat® PVDF
- Colorcoat® High Reflect
- Colorcoat® PE 15
- Colorcoat® PE 25
- Colorcoat® SDP 35
- Colorcoat® SDP 50
- Colorfarm® 15 (a Colorcoat® product)
- Colorfarm® 20 (a Colorcoat® product)

The results presented in this EPD are average values for these products manufactured at each of the three sites, weighted by the tonnage produced at each site. EPDs are also available for Colorcoat® branded products – Colorcoat HPS200 Ultra® and Colorcoat Prisma®.

2.2 Manufacturing

The manufacturing sites included in the EPD are listed in Table 1 below.

Table 1 Participating sites

Site name	Product	Manufacturer	Country
Port Talbot	Hot Rolled Coil	Tata Steel	UK
Llanwern	Cold Rolled Coil	Tata Steel	UK
Shotton	Pre-finished steel	Tata Steel	UK
Ijmuiden	Hot Rolled Coil	Tata Steel	NL
Ijmuiden	Cold Rolled Coil	Tata Steel	NL
Ijmuiden	Pre-finished steel	Tata Steel	NL
Maubeuge	Pre-finished steel	Tata Steel	FR

The process of steel coil manufacture at Tata Steel begins with sinter being produced from iron ore and limestone, and together with coke from coal, reduced in a blast furnace to produce iron. Steel scrap is then added to the liquid iron and oxygen is blown through the mixture to convert it into liquid steel in the basic oxygen furnace. The liquid steel is continuously cast into discrete slabs, which are subsequently reheated and rolled in a hot strip mill to produce steel coil.

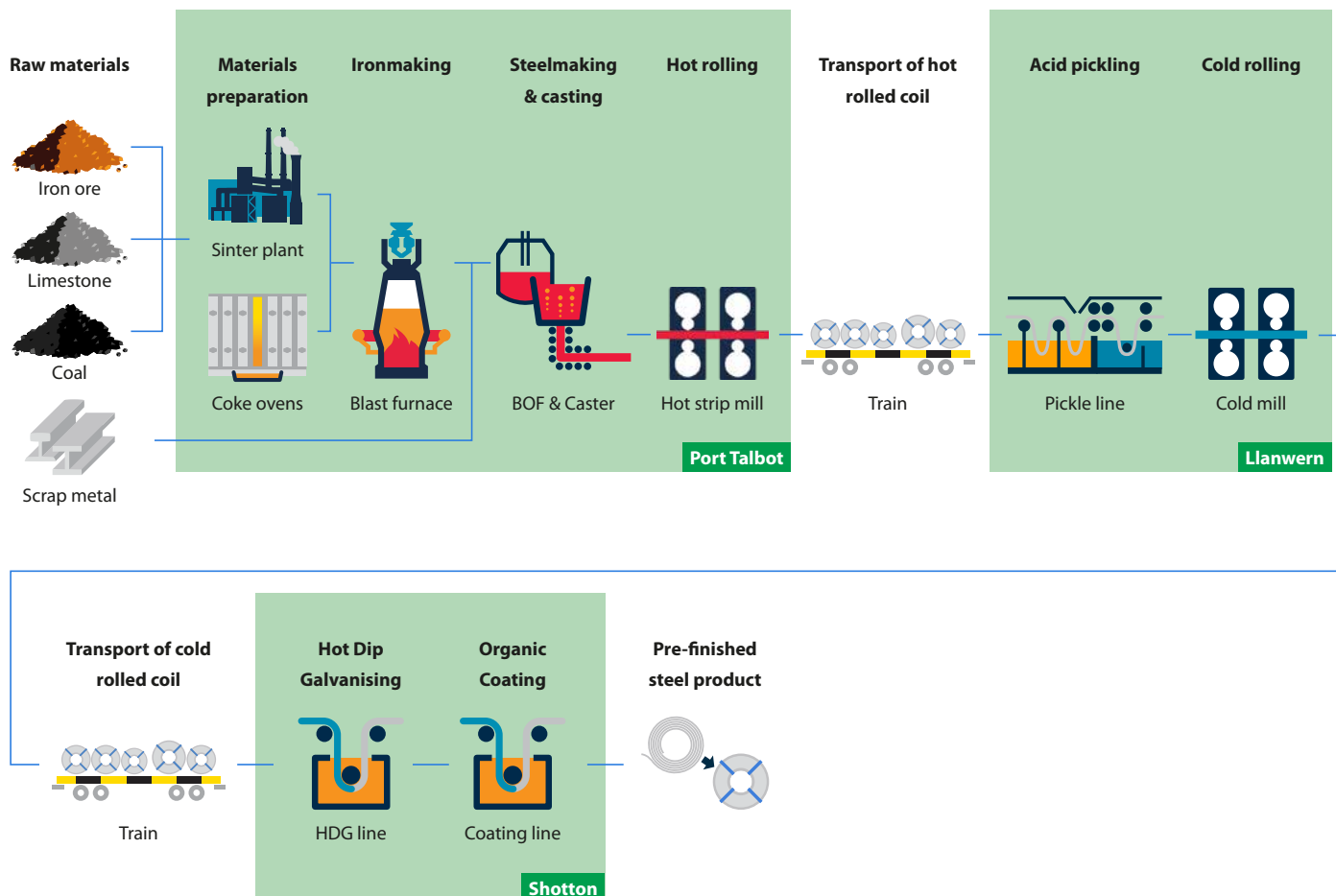
The hot rolled coils from Port Talbot are transported by rail to Llanwern, where they are pickled and cold rolled. Following, cold rolling the coils are despatched by rail to Shotton. Once in Shotton, the coils are hot dip galvanized during which a zinc based metallic coating is applied to the steel coil, before the organic coating is applied in a separate process line. Hot rolled coils from Ijmuiden can be produced in the hot strip mill or at the Direct Sheet Plant, which is a combined casting and rolling facility. These coils are then pickled and cold rolled before being hot dip galvanized and coated, all on the same site.

Hot rolled coil is supplied to Maubeuge by boat and truck from Port Talbot or Ijmuiden, and these coils are pickled and cold rolled before being processed on a combined galvanizing and organic coating line. Cold rolled coil is also supplied to Maubeuge from Llanwern or Ijmuiden, and this is processed on the combined HDG/coating line directly. A small quantity of hot and cold rolled coil is supplied from external sources and this is represented as European average hot and cold rolled coil in the calculations.

Pre-finished steel comprises a number of paint layers and treatments which are applied to the 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 Colorcoat® 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 above topcoats are applied on the top 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 prior to use in the manufacture of building envelope products. An example of the process for the Shotton product is shown in Figure 1.

Process data for the manufacture of hot and cold rolled coil at Port Talbot, Llanwern and Ijmuiden was gathered as part of the latest worldsteel data collection. For these sites together with the Colorcoat® manufacturing facilities at Shotton, Ijmuiden and Maubeuge, the data collection was not only organised by site, but also by each process line within the site. In this way it was possible to attribute resource use and emissions to each process line, and using processed tonnage data for that line, also attribute resources and emissions to specific products where required.

Figure 1 Process overview from raw materials to pre-finished steel



2.3 Technical data and specifications

The technical specifications of the product are shown in Table 2.

Table 2 Technical specification of the pre-finished steel

Colorcoat® pre-finished steel	
Metallic coating	Colorcoat® pre-finished steel is supplied with a zinc based metallic coating that conforms to EN 10346:2015 ^[8]
Paint coating (organic)	All Colorcoat® pre-finished steel is fully REACH ^[9] compliant and chromate free
Certification	<p>Certifications applicable to Tata Steel's Shotton site are; ISO 9001 ^[10], ISO 14001 ^[11], OHSAS 18001 ^[12] BES 6001 certification ^[13], BBA certification ^[14] RC5, Ruv4, CPI5 certificates in accordance with EN 10169 ^[15]</p> <p>Certifications applicable to Tata Steel's IJmuiden site are; ISO 9001 ^[10], ISO 14001 ^[11], BES 6001 certification ^[13]</p> <p>Certifications applicable to Tata Steel's Maubeuge site are; ISO 9001 ^[10], ISO 14001 ^[11]</p>

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 the customer.

2.5 Reference service life

A reference service life for pre-finished steel is not declared because the construction application is not part of the LCA study. To determine the full service life of pre-finished steel, all factors would need to be included, such as details of the final product, and its location and environment.

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 options) and the modules considered in the LCA are;

A1-A3: Production stage (Raw material supply, transport to production site, manufacturing)

C2-C4: End-of-life (Transport, processing for recycling & reuse and disposal)

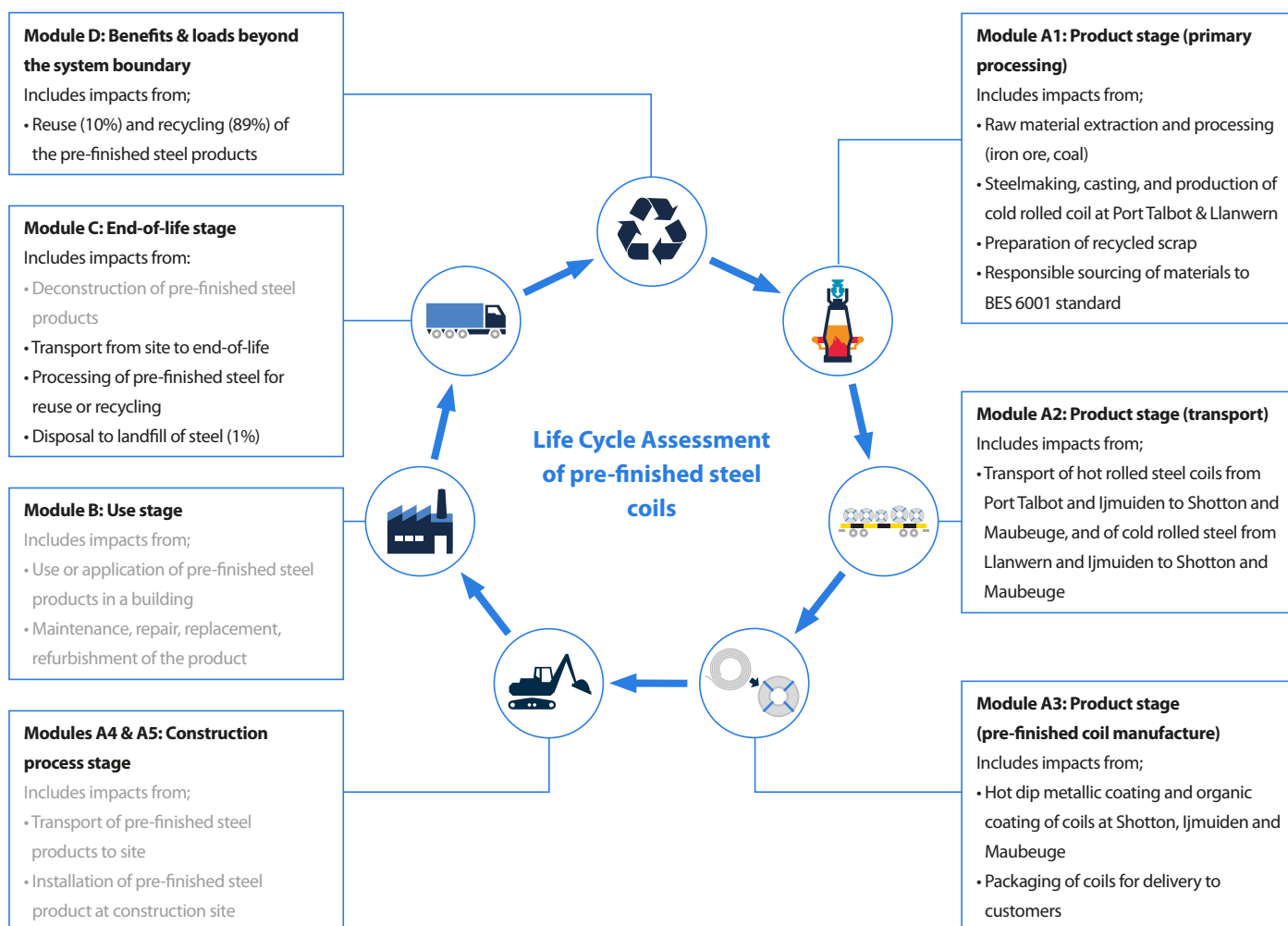
D: Reuse, recycling and recovery

The life cycle stages are explained in more detail in Figure 2.

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 the pre-finished steel have been omitted. On this basis, there is no evidence to suggest that input 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



3.4 Background data

For life cycle modelling of the steel, the GaBi Software System for Life Cycle Engineering is used ^[16]. The GaBi database contains consistent and documented datasets which can be viewed in the online GaBi documentation ^[17].

Where possible, specific data derived from Tata Steel's own production processes were the first choice to use where available. Data was also obtained directly from the relevant suppliers, such as the paint which is used in the coating process.

To ensure comparability of results in the LCA, the basic data of the GaBi database were used for energy, transportation and auxiliary materials.

3.5 Data quality

The data from Tata Steel's own production processes are from 2013 and 2016, and the technologies on which these processes were based during that period, are those used at the date of publication of this EPD. All relevant background datasets are taken from the GaBi software database, and the last revision of all but two of these data sets took place less than 10 years ago. However, the contribution to impacts of both of these datasets is small and relatively insignificant, and therefore, the study is considered to be based on high quality data.

3.6 Allocation

To align with the requirements of EN 15804, a methodology is applied to assign impacts to the production of slag and hot metal from the blast furnace (co-products from steel manufacture), that was developed by the World Steel Association and EUROFER ^[18]. This methodology is based on physical and chemical partitioning of the manufacturing process, and therefore avoids the need to use allocation methods, which are based on relationships such as mass or economic value. It takes account of the manner in which changes in inputs and outputs affect the production of co-products and also takes account of material flows that carry specific inherent properties. This method is deemed to provide the most representative method to account for the production of blast furnace slag as a co-product.

Economic allocation was considered, as slag is designated as a low value co-product under EN 15804. However, as neither hot metal nor slag are tradable products upon leaving the blast furnace, economic allocation would most likely be based on estimates. Similarly BOF slag must undergo processing before being used as a clinker or cement substitute. The World Steel Association and EUROFER also highlight that companies purchasing and processing slag work on long term contracts which do not follow regular market dynamics of supply and demand.

Process gases arise from the production of the continuously cast steel slabs at Port Talbot and are accounted for using the system expansion method. This method is also referenced in the same EUROFER document and the impacts of co-product allocation, during manufacture, are accounted for in the product stage (Module A1).

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 ^[19]. 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 3. The end-of-life percentages are taken from a Tata Steel/ EUROFER recycling and reuse survey of UK demolition contractors for steel cladding carried out in 2014 ^[20].

The environmental impacts presented in the 'LCA Results' section (4) are expressed with the impact category parameters of Life Cycle Impact Assessment (LCIA) using characterisation factors. The LCIA method used is CML 2001-April 2013 ^[21].

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, 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 assessment, in order to capture any differences in other aspects

of the building 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.

Table 3 Main scenario assumptions

Module	Scenario assumptions
A1 to A3 – Product stage	Manufacturing data from Tata Steel sites at Port Talbot, Llanwern, Shotton, IJmuiden and Maubeuge are used
A2 - Transport to the pre-finished steel manufacturing site	The Colorcoat® manufacturing facilities are located at Shotton, IJmuiden and Maubeuge. The cold rolled steel coils are transported to Shotton by rail from Llanwern, a distance of 336km. A utilisation factor of 45% was assumed to account for empty returns. The Colorcoat® facility at IJmuiden is on the same site as primary manufacturing. For Maubeuge, hot and cold rolled coil is transported mainly by ship from South Wales (1200km) and IJmuiden (350km) with a utilisation factor of 50%. Part of these journeys are by road, and a 25 tonne capacity truck with 45% utilisation is assumed.
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
D – Reuse, Recycling, 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

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	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	X	X	X	X

X = Included in LCA; MND = module not declared

Environmental impact:

1 tonne of Colorcoat® pre-finished steel

Parameter	Unit	A1 – A3	C2	C3	C4	D
GWP	kg CO ₂ eq	2.69E+03	1.87E+01	1.04E+01	1.49E-01	-1.58E+03
ODP	kg CFC11 eq	2.33E-05	3.07E-15	4.50E-10	8.64E-16	-8.85E-08
AP	kg SO ₂ eq	5.48E+00	5.05E-02	3.09E-02	8.92E-04	-3.10E+00
EP	kg PO ₄ ³⁻ eq	6.31E-01	1.28E-02	2.94E-03	1.01E-04	-2.45E-01
POCP	kg Ethene eq	8.28E-01	-1.81E-02	2.13E-03	6.96E-05	-6.95E-01
ADPE	kg Sb eq	1.34E-01	1.43E-06	4.26E-06	5.47E-08	-3.00E-02
ADPF	MJ	2.81E+04	2.52E+02	1.49E+02	2.08E+00	-1.52E+04

GWP = Global warming potential

ODP = Depletion potential of stratospheric ozone layer

AP = Acidification potential of land & water

EP = Eutrophication potential

POCP = Formation potential of tropospheric ozone photochemical oxidants

ADPE = Abiotic depletion potential for non-fossil resources

ADPF = Abiotic depletion potential for fossil resources

Resource use:

1 tonne of Colorcoat® pre-finished steel

Parameter	Unit	A1 – A3	C2	C3	C4	D
PERE	MJ	1.57E+03	1.47E+01	6.23E+01	2.73E-01	7.39E+02
PERM	MJ	1.63E+01	0.00E+00	0.00E+00	0.00E+00	-1.63E+00
PERT	MJ	1.59E+03	1.47E+01	6.23E+01	2.73E-01	7.38E+02
PENRE	MJ	3.10E+04	2.71E+02	2.31E+02	2.32E+00	-1.53E+04
PENRM	MJ	7.16E+02	0.00E+00	0.00E+00	0.00E+00	-7.16E+01
PENRT	MJ	3.18E+04	2.71E+02	2.31E+02	2.32E+00	-1.54E+04
SM	kg	8.69E+01	0.00E+00	0.00E+00	0.00E+00	-8.08E+02
RSF	MJ	9.49E-03	0.00E+00	0.00E+00	0.00E+00	-2.84E-03
NRSF	MJ	-7.50E+00	0.00E+00	0.00E+00	0.00E+00	7.35E-01
FW	m³	3.06E+00	2.83E-01	1.35E-01	1.29E-02	-6.07E+00

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 = Use 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 Colorcoat® pre-finished steel

Parameter	Unit	A1 – A3	C2	C3	C4	D
HWD	kg	2.55E+00	0.00E+00	0.00E+00	0.00E+00	-2.55E-01
NHWD	kg	1.11E+02	0.00E+00	0.00E+00	1.00E+01	-1.11E+01
RWD	kg	6.22E-01	3.43E-04	2.76E-02	2.89E-05	-6.17E-02
CRU	kg	0.00E+00	0.00E+00	6.76E+01	0.00E+00	3.24E+01
MFR	kg	7.60E+00	0.00E+00	6.01E+02	0.00E+00	2.88E+02
MER	kg	1.51E+00	0.00E+00	0.00E+00	0.00E+00	-1.51E-01
EEE	MJ	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

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 each of the seven environmental impact categories for 1 tonne of Tata Steel's Colorcoat® pre-finished steel. 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 all impact categories are A1-A3 (burdens) and D (benefits and loads beyond the system boundary).

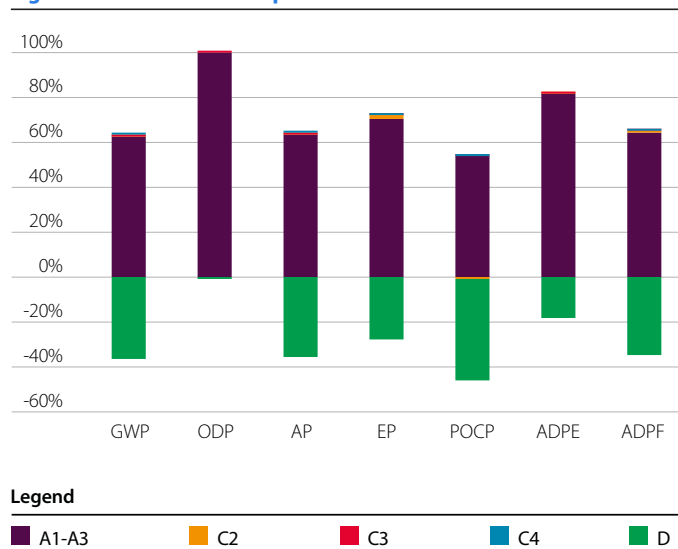
The manufacture of the cold rolled coil during stage A1-A3 is responsible for between 75% and 80% of each impact in most of the categories, specifically, the conversion of iron ore into liquid steel which is the most energy intensive part of the manufacturing process.

The primary site emissions come from the use of coal and coke in the blast and basic oxygen furnaces as well as combustion of the process gases. These processes give rise to emissions of CO₂, which contributes 94% of the Global Warming Potential (GWP), and sulphur oxides, which are responsible for almost two thirds of the impact in the Acidification Potential (AP) category. In addition, oxides of nitrogen are emitted which contribute one third of the A1-A3 Acidification Potential, and almost 80% of the Eutrophication Potential (EP), and the combined emissions of sulphur and nitrogen oxides, together with a relatively large emission of carbon monoxide, all contribute to the Photochemical Ozone indication (POCP).

Figure 3 clearly indicates the relatively small contribution to each impact from the other life cycle stages, C2, C3 and C4. Of these stages, the most significant contribution is from stage C2 (transport to end of life) in the Acidification (AP) and Eutrophication (EP) Potential indicators, and this is mainly the result of nitrogen oxides emissions from the combustion of diesel fuel used in road transport.

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 cladding is modelled with a credit given as if it were re-melted in an Electric Arc Furnace and substituted by the same amount of steel produced in a Blast Furnace^[19]. This contributes a significant reduction to most of the environmental impact category results, with the specific emissions that represent the burden in A1-A3, essentially the same as those responsible for the impact reductions in Module D.

Figure 3 LCA results for the pre-finished steel



The Ozone Depletion indicator (ODP) shows a burden in Module D, whereas most indicators show an impact reduction or benefit. This burden comes from the recycling of the organic coated strip at end-of-life. The very different energy sources (coal versus grid electricity mix) and technologies (BF/BOS versus EAF) are the main factors why the recycling impact for ODP is larger than that of primary manufacture, and the Module D burden arises because of the allocation methodology used in the worldsteel model for calculating the 'value of scrap' process in GaBi.

Referring to the LCA results table, the impact in Module D for the Use of Renewable Primary Energy (PERT) is also different to other impact categories, being a burden or load rather than a benefit. Renewable energy consumption is strongly related to the use of electricity during manufacture, and as the recycling (EAF) process uses significantly more electricity than primary manufacture (BF/BOS), there is a positive value for renewable energy consumption in Module D but a negative value for non-renewable energy consumption.

6 References and product standards

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