Environmental Product Declaration

In accordance with ISO 14025 and EN 15804 for:

Fabricated steel reinforcement products (cut and bent rebar)

from

HY-TEN

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Programme information

Programme:	The International EPD® System EPD International AB Box 210 60 SE-100 31 Stockholm Sweden www.environdec.com info@environdec.com

Product category rules (PCR): PCR 2012:01 Construction products and construction services, version 2.3, UN CPC code 412: products of iron or steel.
PCR review was conducted by: The Technical Committee of the International EPD® System. Chair: Massimo Marion (info@envirodec.com).
Independent third-party verification of the declaration and data, according to ISO 14025:2006: ☐ EPD process certification ☒ EPD verification
Third party verifier: Jane Anderson, ConstructionLCA Ltd
Procedure for follow-up of data during EPD validity involves third party verifier: ☐ Yes ☒ No

The EPD owner has the sole ownership, liability, and responsibility for the EPD. EPDs within the same product category but from different programmes may not be comparable. EPDs of construction products may not be comparable if they do not comply with EN 15804.

Company information

Owner of the EPD: Hy-Ten Ltd., Adam Kurszewski, +44 (0)1634 893487, ak@hy-ten.co.uk, Gresham Road, Staines, Middlesex, TW18 2BJ, United Kingdom.

Description of the organisation: Hy-Ten is a leading stockist and fabricator of concrete reinforcement bar, mesh and accessories with a nationwide network of 12 manufacturing centres from which we provide an innovative, rapid and cost-effective service to building and civil engineering contractors throughout the UK, Eire and the World. Hy-Ten is a major distributor of industrial welded mesh, security fencing, gabions and other land reinforcement products. They also manufacture structural steelwork and general steel fabrications.

Product-related or management system-related certifications: ISO 19001, ISO 14001, ISO 45001, BES 6001, BS 7123, member of Eco-Reinforcement.

Name and location of production sites:

- Hy-Ten Staines: Gresham Road, Staines, Middlesex, TW18 2BJ; and
- Hy-Ten Chatham: Chatham Docks, Chatham, Kent, ME4 4SR.

Product information

Product name: Fabricated steel reinforcement products (cut and bent rebar).

Product identification: CARES approved grade 500 N/mm² cut and bent reinforcement bar to BS 4449:2005.

Product description: Hy-Ten produce cut and bent hot rolled ribbed steel reinforcement bar for use in the reinforcement of concrete in the following sizes: (mm): 6, 8, 10, 12, 14, 16, 18, 20, 25, 32, 40, 50.

UN CPC code: 412: products of iron or steel.

Other codes for product classification: BS 8666:2005 shape codes: 00, 01, 11, 12, 13, 14, 15, 21, 22, 23, 24, 25, 26, 27, 28, 29, 31, 32, 33, 34, 35, 36, 41, 44, 46, 47, 51, 56, 63, 64, 67, 75, 77, 98, 99.

Geographical scope: United Kingdom.

LCA information

LCA practitioners: Dr Matt Fishwick, Anthesis (UK) Ltd, matt.fishwick@anthesisgroup.com and Dr Alan Spray, Anthesis (UK) Ltd, alan.spray@anthesisgroup.com.

Declared unit: 1 tonne of fabricated reinforced steel product produced in the UK.

Time representativeness: Primary data covers a period of 01.01.17 to 31.01.17, with all secondary data used <3 years difference to year of study.

Database(s) and LCA software used: Secondary data from the ecoinvent v3.4 database (EuGeos'15804-IA v3.0 extended version), cut-off by classification. LCA model built in Excel using openLCA for additional modelling.

Process flow diagram: See Figure 1.

Description of system boundaries: The system boundary of this LCA study was "**cradle-to-gate**", covering the following EN 15804 information modules: A1 raw material supply, A2 transport and A3 manufacturing. This includes the extraction and production of raw materials, manufacturing processes, all transportation stages and waste management through to the "gate" boundary.

Excluded lifecycle stages: No lifecycle stages over the cradle-to-gate boundary were excluded. However, all other building life cycle stages are excluded, which comprise: A4 transport, A5 construction-installation process, B1 use, B2 maintenance, B3 repair, B4 replacement, B5 refurbishment, C1 de-construction demolition, C2 transport, C3 waste processing, C4 disposal and D benefits and loads beyond the system boundary.

Product system description: Hy-Ten produce cut and bent hot rolled ribbed steel reinforcement bar for use in the reinforcement of concrete. The processes in this cradle-to-gate lifecycle are described below and presented in the process flow in Figure 1:

- **A1 raw materials supply**: iron ore is mined, molten iron extracted from the ore in a blast furnace and impurities remove in a basic oxygen furnace to produce steel billets. In addition, scrap steel is added to an electric arc furnace to melt it and convert it into high quality steel before it is cast into billets. Rod/bar reinforcing steel is produced by Celsa and other manufacturers by heating steel billets, which are in turn pushed through a series of rolling stands with grooved cylindrical rolls, each with a smaller diameter than the previous. No other raw materials are considered in the product system. Packaging materials were excluded based on immateriality.
- **A2 transport**: rod/bar reinforcing steel manufactured by Celsa in Cardiff and other manufacturers is transported to Hy-Ten sites in the UK via road and sea.
- **A3 manufacturing**: rod/bar reinforcing steel is cut to the desired length and bend to the desired shape at Hy-Ten sites.

Goal of study: The goal of this study was to generate an environmental profile to be reported in an EPD of the following fabricated reinforcing steel product to better understand the associated lifecycle environmental impacts.

Intended use: This LCA study will allow Hy-Ten to identify the relative contribution to environmental impact of all processes in the product lifecycle. Therefore, it will allow them to identify the relative contribution to environmental impact of all processes of the product system under investigation and help identify 'hotspots' where mitigation measures can be targeted.

Results from this study will be used to communicate the environmental performance of the product system to customers and other stakeholders, in the form of an EPD. In each case, the intended use of this EPD is business-to-business communication, not business-to-consumer communication.

Cut-off criteria: No lifecycle stages over the cradle-to-gate boundary were excluded. In this study, exclusions could be made if they were expected to be within the below criteria:

- **Mass**: if a flow is anticipated to be less than 1% of the mass of the product it may be neglected;
- **Energy**: if a flow is anticipated to be less than 1% of the cumulative energy it may be neglected; and
- **Environmental significance**: if a flow is anticipated to be less than 1% of the key impact categories it may be excluded.

If an item meets one of the criteria but is expected to be significant for one of the other criteria it may not be neglected.

Exclusions: Lifecycle stages that have been omitted from the scope of the study include the following:

- Human energy inputs to processes;
- Production and disposal of the infrastructure (machines, transport vehicles, roads, etc.) and their maintenance;
- Environmental impacts related to storage phases;

- Losses of product at different points in the supply chain, for instance during handling and storage;
- Transport of employees to and from their normal place of work and business travel;
- Environmental impacts associated with support functions (e.g. R&D, marketing, finance, management etc.); and
- Primary, secondary and tertiary packaging of raw materials and finished products (estimated to be <0.1% of product by mass for finished products).

Data quality: Data quality requirements followed those of ISO 14040/44, EN 15804 and PCR 2012:01. To ensure the quality of data was sufficient data quality checks were completed on key data parameters through the use of data quality indicators using a data quality matrix and assigning scores between 1 (best) and 5 (worst). The range of scores for primary and secondary data used in this study can be summarised as:

- **Reliability**: mostly 2, some 4.
- **Representativeness**: mostly 1 and 2, some 5.
- **Temporal correlation**: all 1.
- **Geographical correlation**: mostly 1, some 2 and 3.
- **Technological correlation**: mostly 1, some 2 and 3.

Data collection procedures: Quantitative and qualitative primary and secondary data were collected for all processes within the system boundary (with the exception of exclusions described above) and these data were used to compile the life cycle inventory.

In this study, primary data were collected for all process likely to be under the operational control of Hy-Ten over the period of 01/01/2017 to 31/12/2017 and most other processes were modelled using secondary data. Primary data were collected from Hy-Ten using data collection sheets via an iterative process and comprised general site information including annual production masses, annual raw materials used, annual energy and fuel use, annual fugitive and process emissions, annual solid and liquid waste treatment. Further primary data came in the form of an EPD from one of Hy-Ten's suppliers, Celsa Steel UK Ltd (BREG EN EPD No 000187).

Secondary data were collected primarily from extended version of the ecoinvent v3.4 database (EuGeos'15804-IA v3.0).

A mass balance of materials for the Staines site showed that 1.275 tonnes of steel per tonne of product was bought to site, 1 tonne per tonne was used in cut and bent rebar and 0.029 tonnes per tonne of product left as waste, leaving 0.246 tonnes per tonne of product that was stockpiled and used following 31/12/17. In the case of the Chatham site, 1.155 tonnes of steel per tonne of product was brought to site, 1 tonne per tonne was used in cut and bent rebar and 0.023 tonnes per tonne of product left as waste, leaving 0.132 tonnes per tonne of product stockpiled and used following 31/12/17.

Life cycle impact assessment method (LCIA): In this study, the LCIA methods prescribed in EN 15804 and the construction products PCR (CML-IA v4.1) were used.

The CML-IA impact assessment method transformed data gathered in the inventory phase to several indicator scores for various impact categories, giving a broad range coverage of environmental issues. These indicator scores express the relative severity on an environmental impact category and are represented here at the 'mid-point' stage. At the 'mid-point' stage, individual impact categories are shown, whereby a score is given for each in the appropriate reference unit. Note that estimated impact results are only relative statements which do not indicate the end points of the impact categories, exceeding threshold values, safety margins or risks.

Characterisation models and factors from CML-IA v4.1 were used unaltered and as provided and calculation of other EN 15804 parameters was carried out using EuGeos EN 15804-IA data and methods unaltered and as provided. Long term (> 100 years) emissions were excluded from this study.

Average LCIA results for the product system were generated using individual per declared unit LCIA results from each Hy-Ten site and weighting them based on the mass of production output from each site.

General allocation procedures: Site level allocation of primary data at the A3 manufacturing stage was not necessary as the product under investigation is the only product manufactured at Hy-Ten sites Staines and Chatham.

In the case of secondary data, in most cases an extended version of the ecoinvent v3.4 database (EuGeos'15804-IA v3.0) was applied in this study. Where allocation of flows between multi-product processes was carried out in the EuGeos EN 15804-IA version of ecoinvent, an economic approach was used in most cases. with some mass-based allocation, where there was a direct physical relationship. The allocation approach of specific ecoinvent modules is documented on their website and method reports (see www.ecoinvent.org).

End-of-life allocation procedures: In this study a cut-off method was applied to all cases of end-of-life allocation, including in the case of secondary data, where the EuGeos EN 15804-IA version of ecoinvent v3.4 with a cut-off by classification end of life allocation method was used. This was also used for the consumption of recycled materials at the start of life and for the sending of materials to recycling or material reuse at the end-of-life. In this approach the environmental burdens and benefits of recycled / reused materials are given to the product system consuming them, rather than the system providing them. This is known as the cut-off, recycled content or 100:0 approach. This is a common approach in LCA, follows the ISO standards on LCA and prescribed in EN 15804.

Assumptions: During this LCA a number of assumptions were made, the most important of which are described below for transparency:

- Secondary data were using for bar/rod reinforcing steel that Hy-ten didn't source from Celsa. In these cases, it was assumed that upstream production of primary steel billets was best represented by the basic oxygen furnace route and that the production of secondary steel billets was best represented by the electric arc furnace route.
- Transportation of raw materials to Hy-Ten sites was based on the most logical route and transportation method from the supplier locations to Staines and Chatham.
- No material or energy flows were allocated to products that are not manufactured at Staines or Chatham sites but are stored there (e.g. mesh). Electricity for lighting storage areas associated with these products was assumed to be minimal.
- Transportation of waste from Hy-Ten sites to materials recovery facilities was assumed to be a distance of 50 km by road.
- Average of refrigerant losses from other Eco-Reinforcement sites was used to estimate refrigerant losses from Hy-Ten sites.
- Hazardous waste from Hy-Ten sites was assumed to consist of hydraulic fluid only and this was estimated as 250 L per year per site.

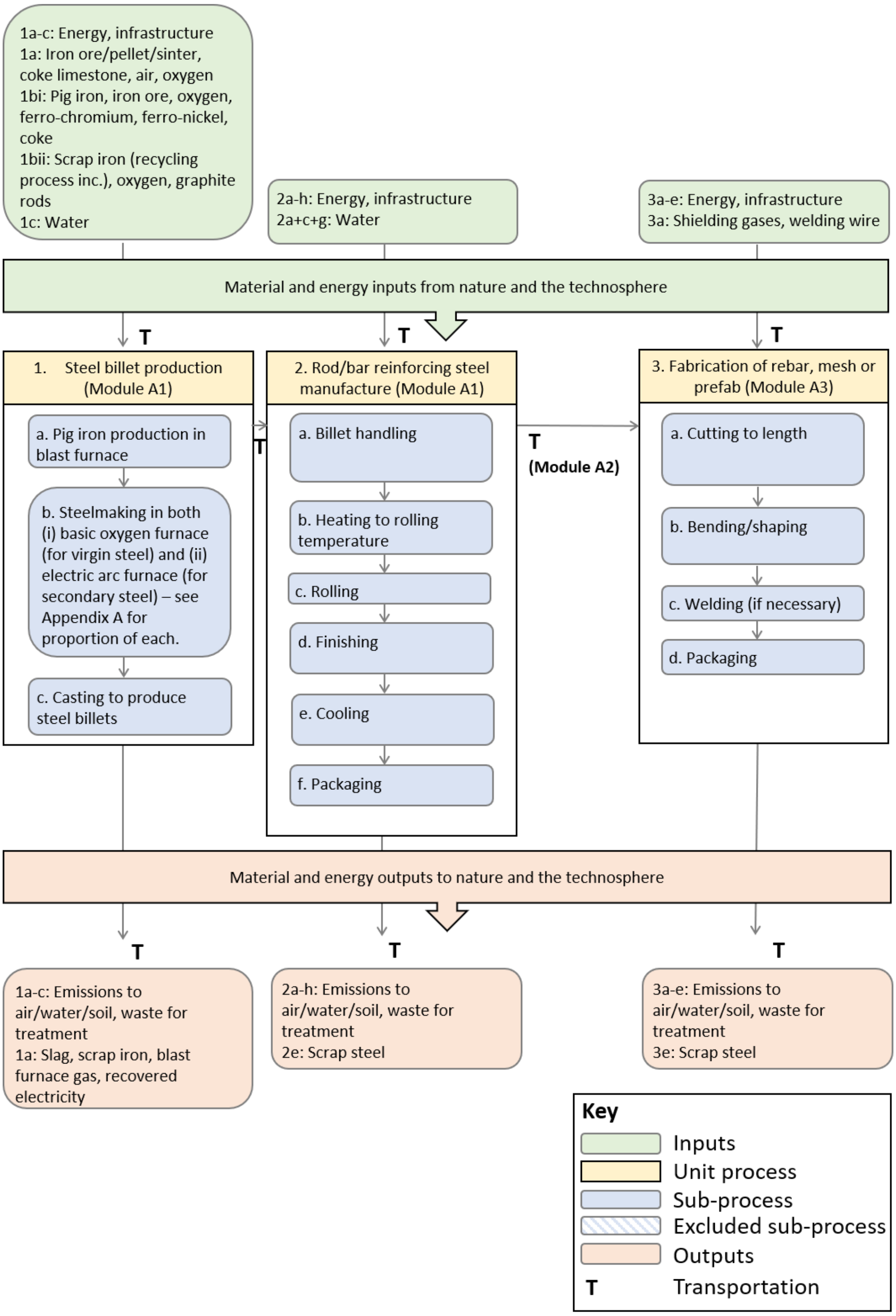

Figure 1 – process flow diagram

Content declaration

Product

Materials / chemical substances	%	Environmental / hazardous properties
Iron	95	n/a
FeSi, SiMn, CiSi, FeB, Al, FeV, C and other charge additives	5	n/a

For construction product EPDs compliant with EN 15804, the content declaration shall list, as a minimum, substances contained in the products that are listed in the “Candidate List of Substances of Very High Concern for Authorisation” when their content exceeds the limits for registration with the European Chemicals Agency.

Packaging

Distribution packaging: Primary, secondary and tertiary distribution packaging of finished products excluded (estimated to be <0.1% of product by mass for finished products).

Consumer packaging: Primary, secondary and tertiary consumer packaging of finished products excluded (estimated to be <0.1% of product by mass for finished products).

Recycled material

Provenience of recycled materials (pre-consumer or post-consumer) in the product: the recycled content of steel supplied to Hy-Ten for use in cut and bent rebar is provided below:

- Supplier A – 100% recycled content.
- Supplier B – 98% recycled content.
- Supplier C – 99% recycled content.
- Supplier D – 22% recycled content.
- Supplier E – 15% recycled content.
- Supplier F – 15% recycled content.
- Supplier G – 99% recycled content.
- Supplier H – 97% recycled content.

Environmental performance

Potential environmental impact

PARAMETER	UNIT	A1	A2	A3	TOTAL A1-A3	A4-5, B1-7, C1-4 and D
Global warming potential (GWP)	kg CO_2 eq.	750.8	17.0	11.3	779.1	MND
Depletion potential of the stratospheric ozone layer (ODP)	kg CFC 11 eq.	7.3E-05	3.5E-06	5.8E-07	7.7E-05	MND
Acidification potential (AP)	kg SO_2 eq.	3.33	0.04	0.06	3.43	MND
Eutrophication potential (EP)	kg PO_4^{3-} eq.	0.56	0.01	0.01	0.57	MND
Formation potential of tropospheric ozone (POCP)	kg C_2H_4 eq.	0.30	0.00	0.00	0.30	MND
Abiotic depletion potential – Elements	kg Sb eq.	4.3E-03	1.1E-04	8.2E-06	4.4E-03	MND
Abiotic depletion potential – Fossil resources	MJ, net calorific value	11,742	279	171	12,192	MND

MND = Module Not Declared.

Use of resources

PARAMETER		UNIT	A1	A2	A3	TOTAL A1-A3	A4-5, B1-7, C1-4 and D
Primary energy resources – Renewable	Use as energy carrier	MJ, net calorific value	1,109.6	5.0	16.3	1,131.0	MND
	Used as raw materials	MJ, net calorific value	1.4E-04	0.0E+00	8.6E-02	8.6E-02	MND
	TOTAL	MJ, net calorific value	1,109.6	5.0	16.4	1,131.1	MND
Primary energy resources – Non-renewable	Use as energy carrier	MJ, net calorific value	14,538	287	171	14,996	MND
	Used as raw materials	MJ, net calorific value	-	-	12.6	12.6	MND
	TOTAL	MJ, net calorific value	14,538	287	183	15,009	MND
Secondary material		kg	1,121	-	-	1,121	MND
Renewable secondary fuels		MJ, net calorific value	-155.89	-0.45	-0.04	-156.39	MND
Non-renewable secondary fuels		MJ, net calorific value	-	-	-	-	MND
Net use of fresh water		m^3	17.68	0.06	0.03	17.77	MND

MND = Module Not Declared.

Waste production and output flows

Waste production

PARAMETER	UNIT	A1	A2	A3	TOTAL A1-A3	A4-5, B1-7, C1-4 and D
Hazardous waste disposed	kg	2.41	0.01	0.01	2.43	MND
Non-hazardous waste disposed	kg	75.2	24.9	0.4	100.4	MND
Radioactive waste disposed	kg	4.9E-02	2.0E-03	4.6E-04	5.2E-02	MND

MND = Module Not Declared.

Output flows

PARAMETER	UNIT	A1	A2	A3	TOTAL A1-A3	A4-5, B1-7, C1-4 and D
Components for reuse	kg	22	-	-	22	MND
Material for recycling	kg	4.9	0.0	24.4	29.4	MND
Materials for energy recovery	kg	2.0E-10	5.6E-12	7.1E-12	2.1E-10	MND
Exported energy, electricity	MJ	-	-	-	-	MND
Exported energy, thermal	MJ	-	-	-	-	MND

MND = Module Not Declared.

References

BRE, 2017. BREG EN EPD 000187. London, BRE, 2017.

BSI, 2010. Environmental labels and declarations – Type III Environmental declarations – Principles and procedures. BS EN ISO 14025:2010. London, BSI, 2010.

BSI, 2011. The Guide to PAS 2050:2011 How to carbon footprint your products, identify hotspots and reduce emissions in your supply chain. BSI, London.

BSI, 2011. PAS 2050:2011 Specification for the assessment of the life cycle greenhouse gas emissions of goods and services. BSI, London.

BSI, 2013. Sustainability of construction works – Environmental product declarations – Core rules for the product category of construction products. BS EN 15804:2012+A1:2013. London, BSI, 2013.

Centrum voor Milieuwetenschappen Leiden (CML), 2012. CML-IA version 4.1 characterisation factors. CML, Leiden.

Ecoinvent, 2018. Ecoinvent v3.3 and v3.4, Swiss Centre for Life Cycle Inventories. Available from www.ecoinvent.ch.

EuGeoes, 2018. EuGeos' 15804-IA Database Version 3.0 Unit and System Processes. EuGeos, Macclesfield.

International EPD® Programme, 2012. Construction Products and Construction Services PCR 2012:01 v2.3. EPD International AB, Stockholm.

International EPD® Programme, 2017. General Programme Instructions of the International EPD® System. Version 3.0. EPD International AB, Stockholm

IPCC, 2007. Working Group I Contribution to the IPCC Fourth Assessment Report Climate Change 2007: The Physical Science Basis, Summary for Policymakers. Intergovernmental Panel on Climate Change, Geneva.

ISO, 2006. Environmental management – life cycle assessment – principles and framework. International Standards Organization, Second Edition, EN ISO 14040.

ISO, 2006. Environmental management – life cycle assessment – requirements and guidelines. International Standards Organization, EN ISO 14044.

JRC, 2011. ILCD Handbook: recommendations for life cycle impact assessment in the European context. European Commission Joint Research Centre Institute for Environment and Sustainability. http://eplca.jrc.ec.europa.eu/?page_id=86.

Pre Consultants, 2018. SimaPro 8.4 LCA Software. http://www.pre-sustainability.com

WRI/WBCSD, 2011. The Product Life Cycle Accounting and Reporting Standard. WRI/WBCSD, Geneva

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