Environmental Product Declaration

EPD of multiple products, based on the average results of the product group. In Accordance with ISO 14025:2006 and EN 15804:2012+A2:2019/AC:2021 for:

Steel Deformed Reinforcing Bar

REOZONE
REINFORCING AUSTRALIA'S FUTURE

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Multiple product grouping	EPD of multiple products, based on the average results of the product group. Products included in this EPD is described on page 6

An EPD should provide current information and may be updated if conditions change. The stated validity is therefore subject to the continued registration and publication at www.epd-australasia.com

EPD® THE INTERNATIONAL EPD® SYSTEM

AUSTRALASIA EPD® ENVIRONMENTAL PRODUCT DECLARATION

ECO PLATFORM EPD VERIFIED

General Information

Programme Information

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Accountabilities for PCR, LCA and independent, third-party verification
Product Category Rules (PCR)
CEN standard EN 15804 serves as the Core Product Category Rules (PCR)
Product Category Rules (PCR): PCR 2019:14, Construction Products, version 1.3.4 UN CPC code: 4124 Bars and rods, hot-rolled, of iron or steel ANZIC classification: 2221 Structural Steel Fabricating
PCR review was conducted by: The Technical Committee of the International EPD® System. See www.environdec.com/TC for a list of members. Review chair: No chair appointed
Life Cycle Assessment (LCA)
LCA accountability: Alexander Munge, CHM Analytics AB
Third-party verification
Independent third-party verification of the declaration and data, according to ISO 14025:2006, via EPD verification by individual verifier Third-party verifier: Claudia A. Peña PINDA LCT SpA Approved by: EPD Australasia
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.

EPD Version 2.0 updates

- Adjusted electricity consumption modelling in module A3 to represent sub-national grid mix of New South Wales, as well as adding description of electricity consumption in module A1
- Adjusted electricity modelling by removing renewables to maintain conservative approach
- Additionally, minor editorial changes were made to the document

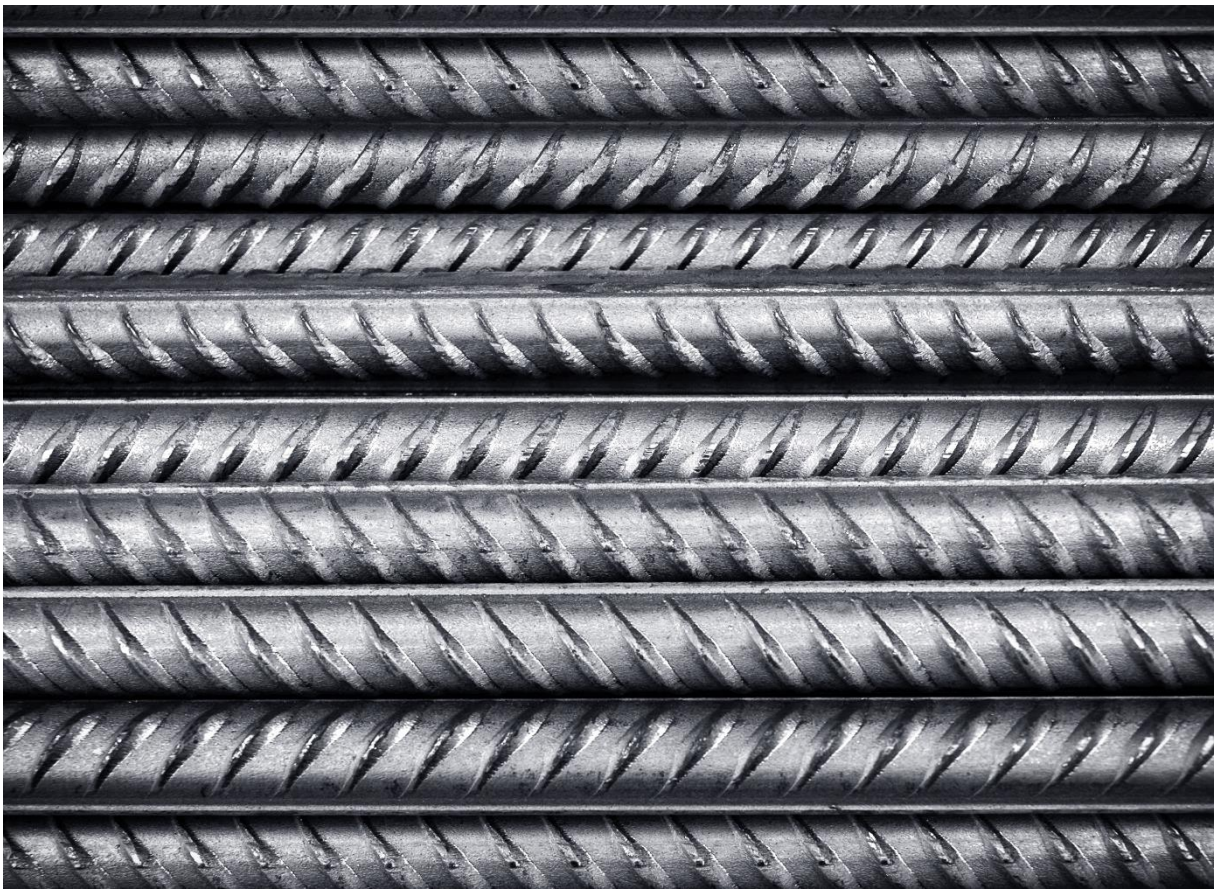
Information on the Use of the EPD

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.

The results for A1-A3 should not only be analysed without considering the impacts represented by module C.

In accordance with EPD Australasia, published EPDs registered with EPD Australasia are recognised by the Green Building Councils of Australia (GBCA) and New Zealand (NZGBC), as well as the Infrastructure Sustainability Council (EPD Australasia, n.d.).

The use of the EPD is restricted to steel supplied by suppliers A, B, and C mentioned in the background LCA report. Contact Reozone directly for information if this EPD is valid for a specific purchase. Reozone also purchases steel from two other ACRS (Australian Certification Authority for Reinforcing and Structural Steels Ltd.) accredited suppliers that are not considered in this report, instead, they will be added to an updated EPD when the two suppliers publish their A2 EPDs on the steel.



Contact Information

Owner of the EPD

Reozone Pty Ltd

Contact

Stuart De Brincat (stuart@reozone.com.au)

Description of the Organisation

With over 30 years experience in the reinforcement industry, Reozone is becoming one of the leading reinforcement companies. Reozone provides an incomparable and quality assured service throughout New South Wales.

What separates Reozone from every other reinforcement service is our approach to work and the experience we have in the residential, commercial, mining, and industrial sectors. Over the last 15 years, our staff have catered to reinforcing projects of every type in Sydney. Reozone is one of the most experienced reinforcement suppliers in Australia.

The success that is steering Reozone into Australia's future lies in its exceedingly qualified team – consisting of experts in the building industry. Reinforced into Reozone's business model is the determination to provide the best service possible to our clients in the shortest time. No matter the size of the project, we provide our clients with not only speed, efficiency, and dependability, but also a level of insurance and simplicity.

Product-Related or Management System-Related Certifications

ISO 9001:2015 Quality Management System

ISO 14001:2015 Environmental Management System

ISO 45001:2018 Occupational Health & Safety

Australian Certification Authority for Reinforcing and Structural Steels Ltd

ISO 14001:2015 – Environmental Management System

ISO 14001:2015 is an internationally recognized standard for environmental management systems (EMS). It helps companies design and implement an EMS to improve their environmental performance. By following this standard, organizations can reduce their environmental impact, comply with legal requirements, and meet their environmental goals. The standard covers everything from resource usage and waste management to monitoring performance and involving stakeholders in environmental initiatives.

In today's world, where environmental issues like climate change and resource depletion are critical, companies must take action. ISO 14001 provides a structured way for businesses to address these challenges. Adopting this standard means committing to reducing waste, saving energy, and cutting costs. It also boosts reputation, builds trust with stakeholders, and is often essential for participating in global trade. Overall, ISO 14001 demonstrates a company's commitment to sustainability and responsible business growth.

Name and Location of Production Site

Reozone ST Marys Office
50-52 Links Road
St Marys
NSW, 2760
Australia

Image on Reozone's project Lumia

Product Information

Product Name

Deformed bar-in-length and deformed bar-in-coil

Product Identification

The product complies with Australian Quality Standard AS/NZS 4671 Steel Reinforcing Materials.

Product Description

The studied products are deformed bar-in-length (DBIL) and deformed bar-in-coil (DBIC) made from steel. Reozone purchases DBIL and DBIC from ACRS accredited suppliers that arrives on semi-trailers and is lifted off by crane or forklift. The material is kept in stock on the warehouse floor until it is placed in Reozone's machinery to cut and bend the DBIL and DBIC. The material is bundled (and some products are placed in bulka bags) before being loaded via crane onto trucks and then transported to site.

The Deformed Reinforcing Bars are used for a variety of projects such as residential and commercial applications, large projects such as multi-story residential complexes, apartment buildings, bridges, DIY projects, and much more

The purchased DBIC is available in coil form and ranges from 10mm to 20mm in diameter, whereas DBIL is available in stock lengths from 6m to 12m and varies from 12mm to 40mm in diameter. The Deformed Reinforcing Bar is processed into customer specifications or stock lengths according to the following table:

Table 1: Overview of physical dimensions for stock lengths of Deformed Reinforcing Bar

Diameter (mm)	Stock lengths (m)	
12	6	**Each bar is available in 500 MPa**
16	6	
16	9	
20	6	
20	12	
24	12	
28	12	
32	12	
36	12	
40	12	

All Deformed Reinforcing Bars comply with Australian Quality Standard AS/NZS 4671 Steel Reinforcing Materials (Australian Certification for Reinforcing and Structural Steels Ltd, 2018).

The EPD is declared as an EPD of multiple products based on the average results of the product group, covering the Deformed Reinforcing Bar in the stock sizes detailed in table 1, as well as sizes based on customer specifications (as long as all other parameters except diameter and stock length remains the same), in accordance with chapter 2.2.2.1 from PCR 2019:14 v. 1.3.4 (The International EPD Programme, 2024). The average results of the product group, covering the various sizes, was calculated by taking the total weight of purchased material during 2023, covering all sizes during that period, and scaling to the declared unit. The weighted average was calculated on the share of the total weight of that product category. The product is not considered an identical product as the end product is sold to customers in various sizes, however, since the declared unit is 1 000 kg of steel product, and the only difference in the end product is the size, the results per declared unit will be the same regardless of the physical dimension the customer decides. The results however do vary depending on which steel is used from which supplier, therefore the results present a weighted average based on purchase volumes from each supplier for full year 2023.

UN CPC classification

- 4124 Bars and rods, hot-rolled, of iron or steel

ANZIC classification

- 2221 Structural Steel Fabricating

Geographical Scope

International coverage. The products are purchased from ACRS accredited suppliers in Turkey and Italy but are used in Australia.

LCA Information

Declared Unit

1 000 kg of steel product

Reference Service Life

Not applicable

Time Representativeness

Specific data collected for production taking place in 2023 (Jan-Dec). All used datasets are currently valid.

Database(s) and LCA Software Used

The LCA software used for modelling was SimaPro version 9.5.0.1, with Ecoinvent 3.9.1 as a complementary database in addition to direct inputs from the steel supplier EPDs.

Description of System Boundaries

EPD type b) Cradle to gate with options, modules C1–C4, module D and with optional modules (A1–A3 + C + D and additional modules). The additional modules included in the system boundary is A4.

No activities or processes were left out in the modelling.

A1-A3 Cradle-to-Gate

Production of steel products from supplier A, B, and C are based on an existing EN15804+A2 EPD. For supplier B, the EPD did not declare the land use indicator and therefore generic datasets from ecoinvent (adjusted to represent the production circumstance at the supplier) was used solely for the land use impact category. The EPD used includes production and handling of raw materials, energy use, auxiliary materials, transportation to production site, disposal, and handling of production scrap.

As presented in chapter 4.5.5 of PCR 2019:14 v 1.3.4, if more than 10% of the GWP-GHG comes from impacts allocated to pre-consumer scrap, it shall be presented in the LCA report and EPD. The pre-consumer scrap steel comes from the A2 EPDs, where either the parameter secondary material or recycled content (when stated) was interpreted to mean pre-consumer scrap. This information is complemented with documents from the suppliers stating the share of post-consumer scrap to get an accurate distribution.

A summary of the scrap types used in the LCA can be found in the chapter Content Information.

The pre-consumer steel has 30.9% of upstream primary steel impacts allocated to it as described in the allocation sub-chapter of this document. This ends up being approximately 643 kg CO_2 – eq per tonne scrap using an adjusted Ecoinvent dataset.

All pre-consumer scrap is allocated an environmental burden as it originates from a previous product system, in accordance with PCR 2019:14 v 1.3.4.

Transportation to Reozone from supplier is covered in A2, according to the following table:

Table 2: Transportation distances from supplier to Reozone

Material	Distance	Unit	Transportation type
DBIL from Supplier A	23	Km	Truck
	10 896	Nautical miles	Boat
	65	Km	Truck
DBIC from Supplier B	105	Km	Truck
	11 535	Nautical miles	Boat
	65	Km	Truck
DBIC from Supplier C	48	Km	Truck
	10 896	Nautical miles	Boat
	65	Km	Truck

In module A3, the electricity consumption, infrastructure requirement, industrial gear oil, and packaging materials was included. The electricity consumption was modelled based on the ecoinvent dataset for Australian grid mix, initially adjusted to the electricity consumption in New South Wales during 2022 (Australian Government - Department of Climate Change, Energy, the Environment and Water, 2023) and then removing the renewables in order to maintain a conservative approach, with a GWP-GHG impact of 1.03 kg CO_2-eq/kWh. Since this is a conservative approach, an additional set of GWP-GHG results are presented as a subsection to the GWP-GHG results in the results chapter, in accordance with PCR 2019:14 v.1.3.4 chapter 5.4.5, which reflects the electricity consumption in New South Wales during 2022, although with renewables included as it provides a more realistic composition of the electricity mix used. The GWP-GHG impact with renewables included is 0.73 kg CO_2-eq/kWh in accordance with the factor provided by The Department of Climate Change, Energy, the Environment and Water for 2023.

All electricity consumption used in the modelling for module A1 is based on the input A2 EPDs from the suppliers. For supplier A and C, both EPDs describe using the consumption grid mix of Turkey based on country specific grid mixes from GaBi 2021 databases. For supplier B, the electricity consumption used in the A2 EPD is not stated.

A4 Transportation

The transportation distance from Reozone to end customer is approximately 25 km, with truck being the mode of transportation. Note that this distance does not necessarily represent a given customer and can vary depending on the customer location.

C1 Demolition

Presented scenarios in modules C1-D are currently in use and are representative for one of the most probable alternatives.

This chapter describes the energy needed to demolish the steel, where the energy requirements for removal of steel is based on (Erlandsson & Pettersson, 2015). As a conservative measure, it is assumed that the demolition takes place more than 6 m above ground level.

Table 3: LCI for deconstruction activities

Activity	Energy Type	Amount (MJ/DU)
Demolition	Diesel	11

C2 Transport to Waste Processing

The transportation distance to waste processing is approximately 40 km to waste facility in Ingleburn, with truck being the mode of transportation.

C3 Waste Processing for Reuse, Recovery and/or Recycling

The materials are assumed to go through a crushing and sorting process according to values in the table below.

Table 4: Activities at the waste pre-processing plant and recycling rates

Material	Treatment type	Amount (kg/DU)
Steel	Sorting and pressing	1 000
Steel	Material recycling	870

C4 Final Disposal

After the recycling streams are separated, the remaining materials are assumed to go to landfill.

Table 5: LCI dataset for product waste treatment

Material	Waste type	Amount (kg/DU
Steel	Inert waste	130

D Benefits and Loads Beyond the Product System

The D module is calculated with a formula originally proposed in EN 15804 and adjusted with a factor for material yield (Y) in PCR:2019:14 v 1.3.4.

Formula for calculating net benefits and loads for export of secondary materials (recycling of materials):

$$e_1 = \Sigma(Y \bullet M_{MR,out} - Y \bullet M_{MR,in}) \bullet (E_{MR\ after\ EoW\ out} - E_{VM\ Sub\ out} \bullet \frac{Q_{R,out}}{Q_{Sub}}) \quad \text{(Eq.1)}$$

No benefits or loads from export of energy.

System Diagram

The system boundary of the EPD is cradle-to-gate with options, meaning that modules A1-A4, C, and D are declared, exempting module A5 + B from the model. Module A1 is represented by the production of steel products from the suppliers, which are then transported to Reozone (module A2). Module A3 includes the processes of cut and bend, as well as packaging of the materials before being sent to end customer (module A4). The installation process and use phase (Module A5 and modules B) are not declared in this EPD.

Module C1-C4 includes the deconstruction of the steel product, transport to waste processing, waste processing and eventually final disposal of material that is not recycled. See the figure below for an overview of included and excluded modules.

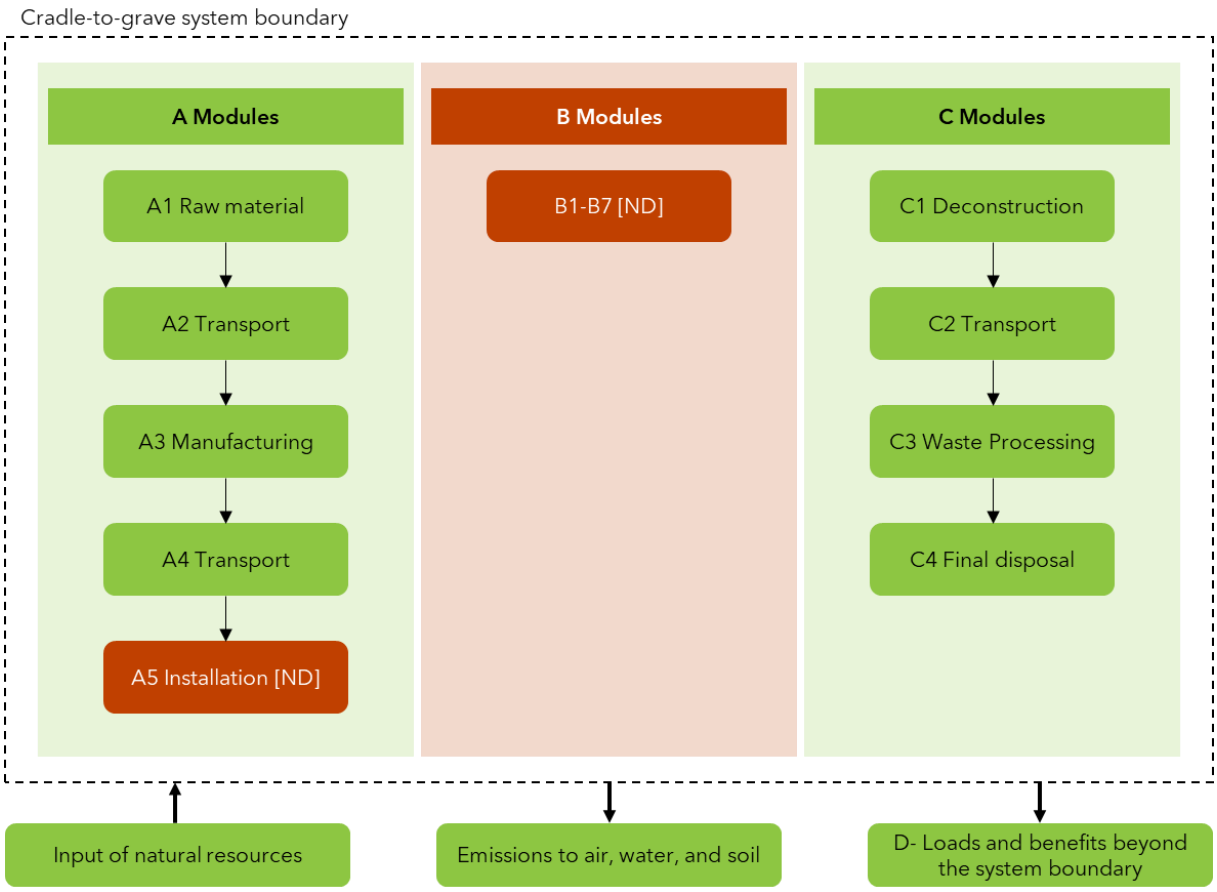


Figure 1: Included modules in the system boundary and exchange to nature

The system boundary to nature is set to include those processes that provide the material and energy inputs into the system and the following manufacturing, and transport processes up to the factory gate as well as the processing of any waste arising from those processes.

All infrastructure/capital goods are included as a standard through the datasets used in ecoinvent for all generic data. Data used from the EPDs (from suppliers of Reozone) cover infrastructure/capital goods in modules A1-A3 if it is deemed relevant and is therefore be included by extension in this LCA.

Assumptions

- When recycled steel is declared to be used as input by the suppliers, but it's not specified whether it is pre- or post-consumer, pre-consumer steel is assumed
- For steel procured directly from a steel manufacturer, the generated scrap is assumed to be remelted inside of the plant and the emissions associated with this is included in the dataset

Cut-Off Rules

The cut-off criteria are in accordance with PCR 2019:14 v 1.3.4, therefore a maximum of 1% of the renewable and non-renewable primary energy use and max 1% of the total mass input of a specific unit are excluded. For a full module, the combined cut-off of all unit processes do not exceed 5%. Particular care should be taken to include materials or processes that have the potential to cause significant emissions into air, water, or soil for any of the declared LCIA categories.

No cut-offs were implemented in this LCA except for the cut-off defined in the EN15804 + A2:2019 EPDs used as inputs, as they will be included as an extension in this LCA.

Allocation

In the EPDs from suppliers A and C, an allocation procedure was described. Since the EPDs were used for modelling, the allocation procedure described in the EPDs are subsequently included in the modelling. For supplier B, which did not have any allocation described in the EPD, no allocation procedure was performed with the exception of that described in chapter 3.2.7.2 below.

All A3 flows existing for Reozone (electricity use, packaging material, and oil for machine maintenance) were allocated based on the mass of the products. All products are simple steel products and have similar economic value, which permits the application of mass allocation in accordance with PCR 2019:14 v 1.3.4.

Allocation Procedure for Pre-Consumer Scrap Steel

The pre-consumer scrap steel was divided through economic allocation according to the table below:

Table 6: Overview of economic allocation for primary and recycled steel

Steel	Timeframe	Average value (€/Metric ton)	Economic allocation
Primary steel	Jan 2023 - Aug 2023	752	69%
Recycled steel	Jan 2023 - Aug 2023	337	31%

For primary steel, data was retrieved from an online source (MEPS International, 2023) where the average price for hot rolled coil steel in Europe between January 2023 and August 2023 was used. The data for recycled steel was taken from the same online source (MEPS International, 2023), where the average price in the Ferrous Scrap Index between January 2023 and August 2023 was used.

Modules Declared, Geographical Scope, Share of Specific Data (in GWP-GHG Indicator) and Data Variation:

Table 7: Declared modules for the life cycle

	Product stage			Construction process stage		Use Stage							End of life stage				Resource recovery stage
	Raw Material Supply	Transport to manufacturing	Manufacturing	Transport to customer	Construction installation	Use	Maintenance	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	De-construction / Demolition	Transport to waste management	Waste processing	Final Disposal	Reuse – Recovery – 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	X	ND	ND	ND	ND	ND	ND	ND	ND	X	X	X	X	X
Geography	GLO	GLO	AUS	AUS	ND	ND	ND	ND	ND	ND	ND	ND	AUS	AUS	AUS	AUS	AUS
Specific data used	>90%																
Variation – Multiple Products*	Steel based on supplier A: +17% Steel based on supplier B: -7% Steel based on supplier C: +4%																
Variation - Sites	0%																

X = Module declared, ND = Module not declared

Share of specific data used was calculated by taking the total GWP-GHG impact of transport in module A2, as well as impacts from Reozone's core processes (manufacturing and product packaging), in accordance with PCR 2019:14 v 1.3.4.

* Variations between the various sizes of the deformed reinforcing bar has 0% in variation of results as the results are based on a declared unit of 1 000 kg of steel products. The sizes only varies in length and diameter, which means that the results per declared unit will be the same.

Image of Reozone's project Alliance Residential

Description of Production Activities

Reozone purchases DBIL and DBIC from supplier sites in Turkey (Suppliers A & C) and Italy (Supplier B), which are transported to Reozone's facility in Australia. Reozone also purchases DBIL from one other ACRS accredited supplier in Turkey and one other ACRS accredited supplier in the United Arab Emirates, however, they are not included in this report and therefore the results are not applicable to steel purchased from Reozone that is originally supplied by the omitted suppliers. The excluded suppliers will be added to an updated EPD when the two suppliers publish their A2 EPDs.

The material is kept in stock on the warehouse floor until it is picked up by a crane and placed onto Reozone's machinery. The material is cut & bent to specifications and bundled with factory tie wire and sling. The bundled material is then ready to be loaded via crane onto trucks and transported to customer site. Some products are also placed in Bulk Bags.

The use phase is not included in the scope of this study. The end-of-life phase is modelled using relevant scenarios combined with generic datasets representative of the regions, in this case Australia.

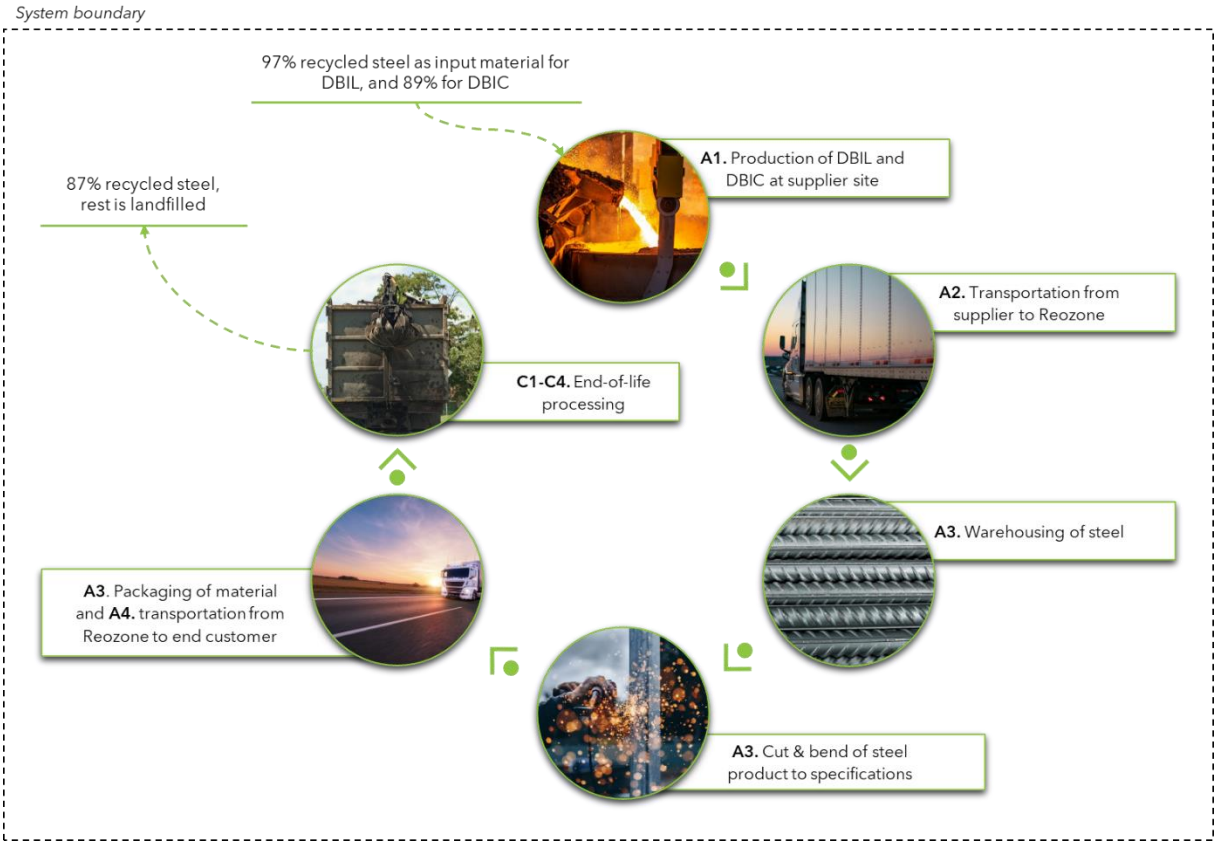


Figure 2: Modelling overview of Reozone's Deformed Reinforcing Bar production and corresponding modules[1]

[1] For information on the values on recycled content, see chapters LCA Information and Content Information

Content Information

Incoming materials ending up in the final product can be seen in the table below, where the weight values are presented per declared unit of 1 000 kg steel product, and the shares are presented as weighted averages.

Table 8: Overview of material content in product, pre- and post-consumer scrap, and biogenic content in material

Product components	Weight, kg/DU	Post-consumer material, weight-%	Pre-consumer material, weight-%	Biogenic material, weight-%	Biogenic material, kg C/DU
Steel DBIL from Supplier A	25	0%	97.1%	0%	0
Steel DBIC from Supplier B	417	77.2%	0.8%	0%	0
Steel DBIC from Supplier C	558	82.0%	18.0%	0%	0
Total, weighted average	**1 000 (total)**	**77.9%**	**12.8%**	**0%**	**0**

Since the Deformed Reinforcing Bar is based on one type of steel purchased from either Supplier A, B, or C, the material content range of weight is between 0 – 1 000 kg/DU for each product component, based on the total weight being 1 000 kg to be in line with the declared unit. The table above presents the weighted average based on full year purchase orders from 2023. The EPD used for the suppliers A did not declare if the scrap steel was post- or pre-consumer, and therefore a conservative assumption was made that all scrap steel used was pre-consumer. The EPD from supplier B did not declare the share of post-consumer scrap in the EPD, however, a document from the Istituto Italiano Di Garanzia Della Qualità confirms a minimum post-consumer scrap content of 77.2% from supplier B. The EPD from supplier C did not declare share of post-consumer scrap either, however, a document from the supplier confirms post- and pre-consumer share.

The chemical composition of the steel from each supplier is presented in the table below. The values are obtained from the EN 15804:2012+A2:2019 EPD from supplier A and C, and a technical specification document from supplier C.

Table 9: Chemical composition of steel used as input material for product

Product	Material/Chemical input	Share of composition
Steel DBIL from Supplier A	Fe	97%
	C, Mn, Si, V, Ni, Cu, Cr, Mo, and others	3%
Steel DBIC from Supplier B	Fe	99.24%
	C, P, S, N, Cu, Ceq	0.76%
Steel DBIC from Suppler C	Fe	97%
	C, Mn, Si, V, Ni, Cu, Cr, Mo, and others	3%

Table 10: Overview of packaging materials used

Packaging material	Weight, kg/DU	Weight-% of product	Biogenic material, kg C/DU
Slings	4.68	<1%	0
Factory tie wire	1.06	<1%	0
Bulka bags	0.05	<1%	0

The product does not contain any substances of very high concern (SVHC) in accordance with the Candidate List of SVHC from the European Chemicals Agency.

Results of Performance Indicators

When analysing the results, the impacts from all modules should be considered. The estimated impact results provide an indication, but should be seen as relative statements, which do not indicate the endpoints of the impact categories, exceeding threshold values, safety margins and/or risks.

The results of the impact categories abiotic depletion of minerals and metals, land use, human toxicity (cancer), human toxicity non-cancer, and ecotoxicity (freshwater) may be highly uncertain in LCAs that include capital goods/infrastructure in generic datasets in case infrastructure/capital goods contribute greatly to the total results. This is due to the LCI data of infrastructure/capital goods used to quantify these indicators in currently available generic datasets sometimes lack temporal, technological, and geographical representativeness. Caution should be exercised when using the results of these indicators for decision-making processes.

According to the Australasian EPD programme regional annex to the GPI of the International EPD® system, the water flows used in Australia should be disaggregated (EPD Australasia, 2023). However, there is no water consumption for Reozone's core processes to produce Deformed Reinforcing Bars and therefore not presented in the results. All significant water consumption is instead included in the A1 processes, which are performed outside of Australia.

All results shown are per declared unit of 1 000 kg steel product. All referenced emission factors are based on the environmental footprint package 3.1 (EF 3.1).

The impact category indicators are presented according to EN 15804:2012+A2:2019/AC:2021. The included impact category indicators are presented in the tables below.

Mandatory Indicators in EN 15804

Table 11: Mandatory impact categories in EN 15804

Impact Category	Indicator	Unit	Model
Climate Change - Fossil	Global Warming Potential fossil (GWP-fossil)	Kg CO_2 eq. (Carbon dioxide equivalents)	Baseline model of 100 years of the IPCC based on IPCC 2021
Climate Change - Biogenic	Global Warming Potential biogenic (GWP-biogenic)	Kg CO_2 eq. (Carbon dioxide equivalents)	Baseline model of 100 years of the IPCC based on IPCC 2021
Climate Change – Land Use and Land Use Change (LULUC)	Global Warming Potential Land use and land use change (GWP-LULUC)	Kg CO_2 eq. (Carbon dioxide equivalents)	Baseline model of 100 years of the IPCC based on IPCC 2021
Climate Change - Total	Global Warming Potential total (GWP-total)	Kg CO_2 eq. (Carbon dioxide equivalents)	Baseline model of 100 years of the IPCC based on IPCC 2021
Ozone Depletion	Depletion potential of the stratospheric ozone layer (ODP)	Kg CFC 11 eq. (Trichlorofluoromethane equivalents)	Steady-state ODPs, WMO 2014.
Acidification	Acidification potential, Accumulated Exceedance (AP)	Mol H+ eq. (Hydrogen ions equivalents)	Accumulated Exceedance, Seppälä et al. 2006, Posch et al., 2008.
Eutrophication aquatic freshwater	Eutrophication potential, fraction of nutrients reaching freshwater end compartment (EP-freshwater)	Kg P eq. (Phosphorous equivalents)	EUTREND model, Struijs et al., 2009b, as implemented in ReCiPe.

Eutrophication aquatic marine	Eutrophication potential, fraction of nutrients reaching freshwater end compartment (EP-marine)	Kg N eq. (Nitrogen equivalents)	EUTREND model, Struijs et al., 2009b, as implemented in ReCiPe.
Eutrophication terrestrial	Eutrophication potential, Accumulated Exceedance (EP-Terrestrial)	Mol N eq. (Nitrogen equivalents)	Accumulated Exceedance, Seppälä et al. 2006, Posch et al.
Photochemical ozone formation	Formation potential of tropospheric ozone (POCP)	Kg NMVOC eq. (Non-methane volatile organic compounds equivalents)	LOTOS-EUROS, Van Zelm et al., as applied in ReCiPe.
Depletion of abiotic resources – Minerals and metals	Abiotic depletion potential for non-fossil resources (ADP-minerals & metals)	Kg sb eq. (Antimony equivalents)	CML 2002, Guinée et al., 2002, and van Ooers et al. 2002
Depletion of abiotic resources – Fossil fuels	Abiotic depletion potential for fossil resources (ADP-fossil)	MJ, net calorific value (Megajoules)	CML 2002, Guinée et al., 2002, and van Ooers et al. 2002
Water deprivation potential	Water (user) deprivation potential, deprivation-weighted water consumption (WDP)	m^3 world eq. Deprived	Available Water Remaining (AWARE) Boulay et al., 2016.

Optional Indicators in EN 15804

The following are additional indicators that are mandatory to present in LCA report and optional in an EPD report according to PCR 2019:14 v 1.3.4.

Table 12: Optional impact categories in EN 15804

Impact Category	Indicator	Unit	Model
Particulate matter emissions	Potential incidence of disease due to PM emissions (PM)	Disease incidence	SETAP-UNEP, Fantke et al 2016
Ionising radiation, human health	Potential Human exposure efficiency relative to U235 (IRP)	kBq U235 eq. (kiloBecquerel equivalents)	Human health effect model as developed by Dreicer et al. 1995 update by Freischknecht et al., 2000
Ecotoxicity (freshwater)	Potential comparative Toxic Units for ecosystems (ETP-fw)	CTUe (Comparative Toxic Units ecosystems)	UseTox version 2 until the modified USEtox model is available from EC-JRC
Human toxicity, cancer effects	Potential comparative Toxic Units for humans (HTP-c)	CTUh (Comparative Toxic Units humans)	UseTox version 2 until the modified USEtox model is available from EC-JRC
Human toxicity, non-cancer effects	Potential comparative Toxic Units for humans (HTP-nc)	CTUh (Comparative Toxic Units humans)	UseTox version 2 until the modified USEtox model is available from EC-JRC
Land use related impacts/soil quality	Potential Soil Quality index (SQP)	Dimensionless	Soil quality index based on LANCA.

Required Indicators in PCR 2019:14

The following indicators are mandatory indicators to report according to PCR 2019:14 v 1.3.4, which states that GWP-GHG shall be reported as well.

Table 13: Impact category GWP-GHG according to PCR 2019:14 v 1.3.4

Impact category	Unit	Model	Comment
Climate Change – GHG	Kg CO_2 eq. (Carbon dioxide equivalents)	Baseline model of 100 years of the IPCC based on IPCC 2021	This impact category is identical to GWP-total except for biogenic CO_2 having a CF = 0.[2]

Indicators Describing Resource Use, Waste & Biogenic Content in EN 15804

The following indicators are mandatory indicators in EN 15804 that describe waste & resource use.

Table 14: Indicators for use of resources according to EN 15804

Parameter	Unit
Use of renewable primary energy excluding renewable primary energy resources used as raw materials	kWh
Use of renewable primary energy resources used as raw materials	kWh
Total use of renewable primary energy resources (primary energy and primary energy resources used as raw materials)	kWh
Use of non-renewable primary energy excluding non- renewable primary energy resources used as raw materials	kWh
Use of non-renewable primary energy resources used as raw materials	kWh
Total use of non-renewable primary energy resources (primary energy and primary energy resources used as raw materials)	kWh
Use of secondary material	kg
Use of renewable secondary fuels	kWh
Use of non-renewable secondary fuels	kWh
Net use of fresh water	m3

Table 15: Indicators for waste production according to EN 15804

Waste production	Unit
Hazardous Waste Disposed	Kg
Non-Hazardous Waste Disposed	Kg
Radioactive Waste Disposed	Kg

Table 16: Indicators for output flows according to EN 15804

Output flows	Unit
Components for reuse	kg
Material for recycling	kg
Materials for energy recovery	kg
Exported energy, electricity	MJ
Exported energy, thermal	MJ

Table 17: Requirements for reporting Biogenic content in product and product packaging

Biogenic carbon content[3]	Unit
Biogenic carbon content in product	Kg C
Biogenic carbon content in accompanying packaging	Kg C
NOTE: 1 kg biogenic carbon is equivalent to 44/12 kg of CO_2.	

[2] Details can be seen in PCR 2019:14 v 1.3.4 Annex 1
[3] No biogenic carbon in product or accompanying packaging

Mandatory Impact Category Indicators

Table 18: Mandatory impact category results per declared unit for Deformed Reinforcing Bar

Indicator	Unit	A1-A3	A4	C1	C2	C3	C4	D
GWP-fossil	kg CO_2 eq.	1.11E+03	4.75E+00	1.10E+00	7.60E+00	3.09E+01	1.05E+00	-1.86E+02
GWP-biogenic	kg CO_2 eq.	3.87E+00	7.80E-04	8.88E-05	1.25E-03	7.36E-02	6.85E-04	8.21E-01
GWP-luluc	kg CO_2 eq.	4.86E-01	1.58E-03	9.57E-05	2.52E-03	3.60E-02	4.44E-04	2.60E-01
GWP-total	kg CO_2 eq.	1.11E+03	4.75E+00	1.10E+00	7.60E+00	3.10E+01	1.05E+00	-1.85E+02
ODP	kg CFC 11 eq.	1.23E-04	9.44E-08	1.69E-08	1.51E-07	3.47E-07	2.77E-08	1.64E-06
AP	mol H^+ eq.	1.32E+01	9.89E-03	9.95E-03	1.58E-02	3.10E-01	6.89E-03	1.84E-01
EP-freshwater	kg P eq.	7.12E-02	3.71E-05	3.88E-06	5.93E-05	1.18E-03	1.34E-05	5.59E-02
EP-marine	kg N eq.	2.72E+00	2.32E-03	4.61E-03	3.71E-03	7.03E-02	2.65E-03	1.16E-01
EP-terrestrial	mol N eq.	2.84E+01	2.56E-02	5.05E-02	4.10E-02	8.07E-01	2.92E-02	-4.34E-01
POCP	kg NMVOC eq.	7.93E+00	1.64E-02	1.51E-02	2.63E-02	2.40E-01	1.04E-02	-8.69E-02
ADP-minerals&metals*	kg Sb eq.	2.00E-03	1.55E-05	3.93E-07	2.47E-05	1.61E-03	2.03E-06	1.81E-03
ADP-fossil*	MJ	1.07E+04	5.56E+00	5.84E-01	8.89E+00	1.24E+02	1.96E+00	-2.32E+03
WDP*	m^3	2.77E+02	2.77E-01	3.12E-02	4.44E-01	4.81E+00	7.39E-01	2.04E+02
Acronyms	GWP-fossil = Global Warming Potential fossil fuels; GWP-biogenic = Global Warming Potential biogenic; GWP-luluc = Global Warming Potential land use and land use change; ODP = Depletion potential of the 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-minerals&metals = Abiotic depletion potential for non-fossil resources; ADP-fossil = Abiotic depletion for fossil resources potential; WDP = Water (user) deprivation potential, deprivation-weighted water consumption							

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

Additional Mandatory and Voluntary Impact Category Indicators

Table 19: Additional impact category results per declared unit for Deformed Reinforcing Bar

Indicator	**Unit**	**A1-A3**	**A4**	**C1**	**C2**	**C3**	**C4**	**D**
Particulate matter	disease inc.	6.49E-05	3.48E-07	2.83E-07	5.57E-07	4.32E-06	1.92E-07	-7.29E-06
Ionising radiation**	kBq U-235 eq	4.00E+00	3.08E-02	2.51E-03	4.93E-02	4.90E-01	7.87E-03	9.24E+00
Ecotoxicity, freshwater*	CTUe	7.88E+02	1.82E+01	2.04E+00	2.91E+01	2.64E+02	1.31E+01	-1.81E+04
Human toxicity, cancer*	CTUh	1.48E-06	3.37E-08	4.31E-09	5.39E-08	2.29E-07	1.23E-08	-6.55E-05
Human toxicity, non-cancer*	CTUh	5.24E-06	4.20E-08	1.78E-09	6.71E-08	1.42E-06	6.51E-09	4.12E-05
Land use*	Pt	2.78E+03	4.04E+01	1.01E+00	6.46E+01	6.45E+02	3.96E+01	1.94E+02

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

*** Disclaimer: 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.*

GWP-GHG Indicator

This table presents global warming potential according to IPCC 2021 GWP 100a without any biogenic uptake.

Table 20: GWP-GHG results per declared unit for Deformed Reinforcing Bar

Indicator	**Unit**	**A1-A3**	**A4**	**C1**	**C2**	**C3**	**C4**	**D**
GWP-GHG[4]	kg CO_2 eq.	1.11E+03	4.75E+00	1.10E+00	7.60E+00	3.10E+01	1.05E+00	-1.85E+02

[4] This indicator accounts for all greenhouse gases except biogenic carbon dioxide uptake and emissions and biogenic carbon stored in the product. As such, the indicator is identical to GWP-total except that the CF for biogenic CO_2 is set to zero.

GWP-GHG Indicator Results For Alternative Electricity Modelling Scenario

This table presents an alternative electricity modelling scenario for module A3 using the New South Wales GWP-GHG factor in accordance with the factor provided by The Department of Climate Change, Energy, the Environment and Water for 2023.

Table 21: GWP-GHG results per declared unit for Deformed Reinforcing Bar with alternative scenario

Indicator	Unit	A1-A3	A4	C1	C2	C3	C4	D
GWP-GHG[4]	kg CO_2 eq.	1.11E+03	4.75E+00	1.10E+00	7.60E+00	3.10E+01	1.05E+00	-1.85E+02

Resource Use Indicators

Table 22: Use of resources per declared unit for Deformed Reinforcing Bar

Indicator	Unit	A1-A3	A4	C1	C2	C3	C4	D
PERE	MJ	1.39E+03	1.15E+00	8.85E-02	1.84E+00	4.97E+01	3.69E-01	3.26E+02
PERM	MJ	4.59E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PERT	MJ	**1.44E+03**	**1.15E+00**	**8.85E-02**	**1.84E+00**	**4.97E+01**	**3.69E-01**	**3.26E+02**
PENRE	MJ	1.10E+04	5.80E+00	6.11E-01	9.27E+00	1.30E+02	2.05E+00	-2.44E+03
PENRM	MJ	1.12E+02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PENRT	MJ	**1.11E+04**	**5.80E+00**	**6.11E-01**	**9.27E+00**	**1.30E+02**	**2.05E+00**	**-2.44E+03**
SM	kg	8.69E+02	0.00E+00	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	0.00E+00
NRSF	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
FW	m^3	8.72E+03	2.22E+02	1.68E+01	3.55E+02	3.41E+03	1.43E+02	7.36E+03
Acronyms	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 re-sources; SM = Use of secondary material; RSF = Use of renewable secondary fuels; NRSF = Use of non-renewable secondary fuels; FW = Use of net fresh water							

Waste Indicators

Table 23: Waste generated exiting the system boundary per declared unit for Deformed Reinforcing Bar

Indicator	Unit	A1-A3	A4	C1	C2	C3	C4	D
Hazardous waste disposed	kg	2.26E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Non-hazardous waste disposed	kg	7.45E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Radioactive waste disposed	kg	4.32E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Output Flow Indicators

Table 24: Other flows exiting the system boundary per declared unit for Deformed Reinforcing Bar

Indicator	Unit	A1-A3	A4	C1	C2	C3	C4	D
Components for re-use	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Material for recycling	kg	8.62E+00	0.00E+00	0.00E+00	0.00E+00	8.70E+02	0.00E+00	0.00E+00
Materials for energy recovery	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Exported energy, electricity	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Exported energy, thermal	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

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