Environmental Product Declaration

In accordance with ISO 14025:2006 and EN 15804:2012+A2:2019/AC:2021 for:

Unalloyed foundry pig iron

from

PJSC "ZAPORIZHSTAL"

Programme:	The International EPD® System, www.environdec.com
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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.environdec.com

General information

Programme information

Programme:	The International EPD® System
Address:	EPD International AB Box 210 60 SE-100 31 Stockholm Sweden
Website:	www.environdec.com
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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.
PCR review was conducted by: The Technical Committee of the International EPD® System. Chair of the PCR review is Claudia A. Peña. The review panel may be contacted via info@environdec.com
Life Cycle Assessment (LCA)
LCA accountability: LCA Studio s.r.o. Mgr. Ivanna Harasymchuk, Ing. et Ing. Tatiana Trecáková, PhD., prof. Ing. Vladimír Kočí, Ph.D., MBA Šárecká 1962/5, 16000 Prague 6, Czech Republic, www.lcastudio.cz LCA Studio
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: prof. Ing. Silvia Vilčeková, Ph.D., Silcert, s.r.o. Approved by: The International EPD® System
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 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.

Company information

Owner of the EPD: **PJSC "ZAPORIZHSTAL"**

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Description of the organisation:

PJSC "ZAPORIZHSTAL" is one of the largest steel producers in Ukraine, specializing in the production of high-quality hot-rolled and cold-rolled steel products, carbon and low-alloy steel sheets, steel strip, black tinplate, commercial pig iron, and slabs. The company is renowned for its commitment to high production standards, product quality, and environmental sustainability.

PJSC "ZAPORIZHSTAL STRUCTURE
To maintain a strong competitive advantage and expand its global presence, Zaporizhstal is part of Metinvest Group, a vertically integrated international steel and mining group. This allows the company to integrate production and distribution capabilities, ensuring high-quality products and professional services for clients worldwide.
The company exports its steel products to more than 50 countries, serving key industries such as construction, mechanical engineering, shipbuilding, automotive, energy, and more. Its primary customers include manufacturers of pipes, metal structures, and machinery, as well as large industrial enterprises.

PRODUCT RANGE & INDUSTRY APPLICATIONS
Zaporizhstal retains a significant market share in Europe and beyond, supplying a wide range of steel products, including:

- Hot-rolled and cold-rolled steel – used in construction, machine building, automotive, and heavy industry
- Steel strips and sheets – for mechanical engineering and industrial applications
- Black tinplate – widely applied in the packaging industry
- Commercial pig iron and slabs – essential for further steel processing and casting

The company continuously modernizes its production facilities to meet the growing demand for high-value-added products that comply with international quality standards.

PJSC "ZAPORIZHSTAL" prioritizes:

- The health and safety of its employees, partners, and visitors
- Environmental protection, focusing on pollution prevention and reducing its carbon footprint
- Sustainable production practices, implementing eco-friendly technologies to minimize industrial emissions and waste

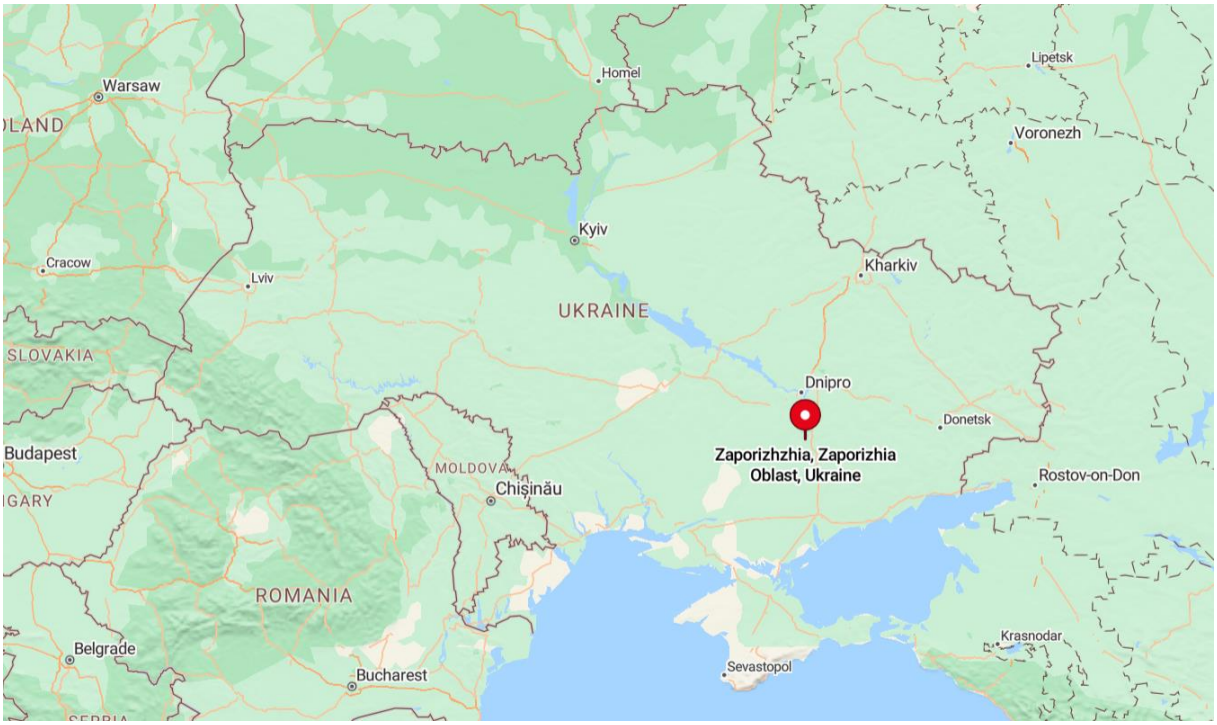
The company is actively investing in modern environmental initiatives, including upgrading its manufacturing processes to comply with European environmental regulations.

Product-related or management system-related certifications:

PJSC “ZAPORIZHSTAL” has an integrated Management System according to standards ISO 9001 and ISO 14001 and ISO 45001, enabling the company to streamline operation, improve efficiency and meet stakeholders expectation. PJSC “ZAPORIZHSTAL” is focuses on consistently delivering high-quality products, emphasizes customer satisfaction, compliance with regularly requirements and continuous improvement. Company promotes sustainability by minimizing the environmental impact of operation, include waste management, pollution prevention and resource conservation from a circular perspective. PJSC “ZAPORIZHSTAL” ensure a safe and healthy workplace for employees, implement measures to identify, evaluate and mitigate occupational hazards. PJSC “ZAPORIZHSTAL” is committed to reduce the intensity and overall level of CO_2 emissions by using energy resources efficiency, implementing best available technologies.

Name and location of production site(s):

Zaporizhstal Steel Works is strategically located in Zaporizhzhia, Ukraine, an important industrial center known for its strong metallurgical and heavy industry base. The production site is situated at:
72 Pivdenne Highway, Zaporizhzhia, 69008, Ukraine



Product information

Product name: Unalloyed foundry pig iron

Product identification:
Unalloyed steelmaking pig iron is a multicomponent alloy primarily composed of iron, carbon, silicon, manganese, phosphorus, and sulfur. It is produced in accordance with DSTU 3133-95 (GOST 805-95) "Steelmaking pig iron. Specifications".
Classification of Foundry Pig Iron:

- Pig iron for foundry production (grades PL1, PL2): Intended for remelting in foundries.
- Pig iron for steelmaking production (grades P1, P2): Designed for steel production.
- High-quality pig iron (grades PVK1, PVK2, PVK3): Characterized by a low content of harmful impurities.
- Phosphorous pig iron (grades PF1, PF2, PF3): Characterized by a high phosphorus content.

Product description:

For pig iron production, sinter, along with coke and fluxes, is loaded into the blast furnaces, of which there are four at the plant. In the blast furnaces, iron is reduced from its oxides at high temperatures (around 2000°C), resulting in the formation of molten pig iron. The smelting of pig iron in the blast furnace is a key stage of metallurgical production at PJSC “ZAPORIZHSTAL”, ensuring the production of an iron-carbon alloy—pig iron—which serves as raw material for further steelmaking or the manufacturing of cast products. The main components of the blast furnace charge are iron ore materials, fuel, and fluxes. Through the top of the furnace, iron ore materials, coke, and fluxes are loaded in batches, while preheated air (at 1000–1200°C), sometimes enriched with oxygen, is injected through tuyeres at the bottom. This promotes coke combustion and the formation of reducing gases. As these gases rise, they react with iron oxides, reducing them to metallic iron. The metallic iron then comes into contact with coke, absorbing carbon and forming pig iron, which has a lower melting point and transitions into a liquid state. Meanwhile, the fluxes react with gangue and coke ash, forming a low-melting slag that absorbs unwanted impurities and accumulates above the layer of molten pig iron. Depending on the specifics of the technological process, the molten pig iron can either be immediately transferred to steelmaking shops for further steel production or sent to casting machines for the production of pig iron ingots. The final product—unalloyed foundry pig iron—is a multi-component iron alloy containing carbon, silicon, manganese, phosphorus, and sulfur. The product complies with DSTU 3133-95 (GOST 805-95) "Steelmaking pig iron. Specifications". Pig iron has two primary applications: steel production and cast product manufacturing. In the first case, pig iron serves as one of the metal charge components in electric arc furnaces, converters, and other steelmaking units. In the second case, pig iron is used as a substitute for steel scrap, direct reduced iron, and, to some extent, molten pig iron. Shipped in batches with an accompanying quality certificate specifying the pig iron grade, group, class, and category.

UN CPC code: 41111 - Pig iron and spiegeleisen in pigs, blocks or other primary forms.

Geographical scope: Global,Ukraine

LCA information

Functional unit / declared unit:

The declared unit refers to 1 ton of unalloyed foundry pig iron.

Time representativeness:

Site specific data from producer are based on 1 year average for process data (reference year 2023). Time scope less than 10-years was applied for background data. Time scope less than 2-years was applied for specific data.

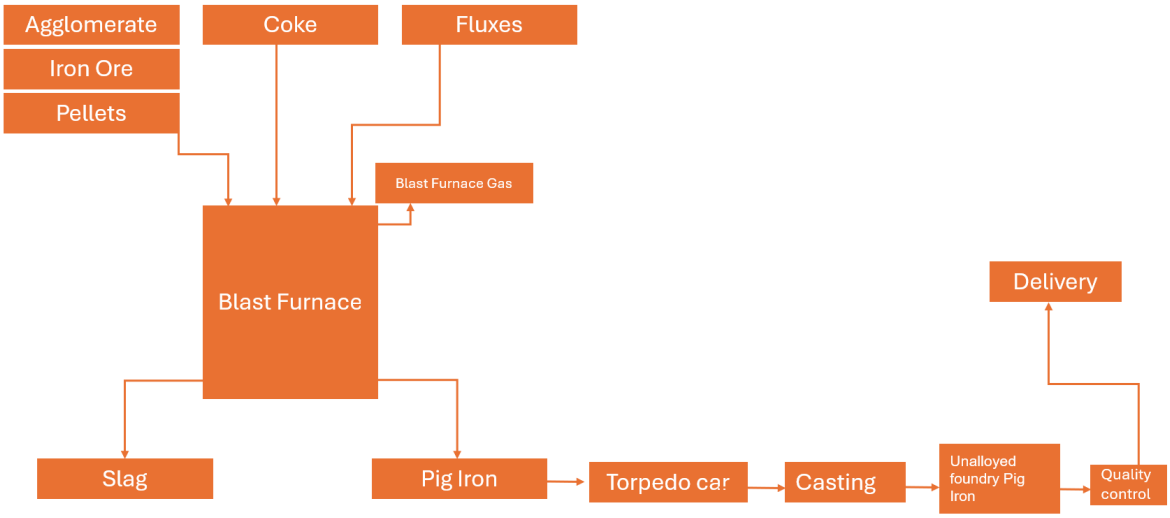
Database(s) and LCA software used:

LCA for Experts (Sphera), Sphera database and ecoinvent database.

Description of system boundaries:

This EPD is based on system boundary cradle to gate, modules C1–C4, module D and with optional modules A4-A5.
The system boundary covers the production of raw materials, all relevant transport down to factory gate, manufacturing by PJSC “ZAPORIZHSTAL”, transport from the by PJSC “ZAPORIZHSTAL” to the site and installation of construction product based at unalloyed foundry pig iron including product unpacking, deconstruction, transport of unalloyed foundry pig iron, sorting of used unalloyed foundry pig iron, treatment of produced waste (recycling and landfill of fractions not entering the recycling treatment).

System diagram:



Cut off rules: The cut-off criterion was chosen based on the used PCR. According to the used PCR, more than 99 % of flows were included.

Allocations: Specific inputs and outputs were measured or calculated for specific product. The allocation of CO_2 emissions was based on a fuel consumption approach. For the allocation of post-industry scrap, an economic approach was applied.

Electricity mix: Generation of electricity consumed within the production was based on the Ukrainian product electricity mix. GWP-GHG indicator of the used Ukrainian product electricity mix is 0,47 kg CO_2eq./kWh.

Characterisation factors: Characterisation factors are based on Environmental Footprint 3.1. (EF 3.1).

Modules declared, geographical scope, share of specific data (in GWP-GHG results) and data variation (in GWP-GHG results):

	Product stage			Construction process stage		Use stage							End of life stage				Resource recovery stage
	Raw material supply	Transport	Manufacturing	Transport	Construction installation	Use	Maintenance	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	De-construction demolition	Transport	Waste processing	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	x	ND	ND	ND	ND	ND	ND	ND	x	x	x	x	x
Geography	GLO	GLO	UA	EU	EU	NR	NR	NR	NR	NR	NR	NR	EU	EU	EU	EU	EU
Specific data used	77,4%			-	-	-	-	-	-	-	-	-	-	-	-	-	-
Variation – products	NR			-	-	-	-	-	-	-	-	-	-	-	-	-	-
Variation – sites	NR			-	-	-	-	-	-	-	-	-	-	-	-	-	-

Content information

Product components	Weight, kg	Post-consumer material, weight-%	Biogenic material, weight-% and kg C/kg
Unalloyed foundry pig iron	1000,0	0,78 %	0
Chemical composition			
Iron	946,9		
Manganese	1,3		
Silicon	6,6		
Carbon	44,6		
Other	0,6		
TOTAL	1000,0	0,78 %	0

Dangerous substances from the candidate list of SVHC for Authorisation	EC No.	CAS No.	Weight-% per functional or declared unit
No substances from the SVHC list to report.			

Results of the environmental performance indicators

Mandatory impact category indicators according to EN 15804

Results per 1 t of unalloyed foundry pig iron									
Indicator	**Unit**	**A1-A3**	**A4**	**A5**	**C1**	**C2**	**C3**	**C4**	**D**
GWP-fossil	kg CO_2 eq.	2,88E+03	5,25E+01	0,00E+00	6,29E+01	1,01E+01	2,07E+01	7,49E-01	-4,08E+02
GWP-biogenic	kg CO_2 eq.	5,96E-01	1,53E-01	0,00E+00	2,10E-02	1,22E-01	9,01E-03	0,00E+00	6,60E-01
GWP-luluc	kg CO_2 eq.	7,18E-01	1,90E-01	0,00E+00	6,23E-03	1,67E-01	2,46E-03	4,49E-03	-1,99E-01
GWP-total	kg CO_2 eq.	2,88E+03	5,28E+01	0,00E+00	6,29E+01	1,04E+01	2,08E+01	7,53E-01	-4,08E+02
ODP	kg CFC 11 eq.	5,50E-06	4,55E-10	0,00E+00	1,35E-05	1,00E-12	1,66E-10	2,04E-12	1,29E-09
AP	mol H^+ eq.	4,79E+00	2,05E-01	0,00E+00	3,93E-01	1,29E-02	4,83E-02	5,31E-03	-9,36E-01
EP-freshwater	kg P eq.	6,64E-02	6,84E-05	0,00E+00	1,95E-03	4,24E-05	8,96E-06	1,71E-06	-3,90E-05
EP-marine	kg N eq.	1,07E+00	7,11E-02	0,00E+00	1,64E-01	4,58E-03	1,12E-02	1,37E-03	-2,27E-01
EP-terrestrial	mol N eq.	1,14E+01	7,79E-01	0,00E+00	1,79E+00	5,50E-02	1,21E-01	1,51E-02	-2,46E+00
POCP	kg NMVOC eq.	4,07E+00	3,50E-04	0,00E+00	5,03E-01	1,28E-02	3,31E-02	4,19E-03	-7,54E-01
ADP-minerals&metals*	kg Sb eq.	1,96E-04	2,89E-06	0,00E+00	3,24E-05	8,46E-07	8,49E-07	4,86E-08	-4,54E-06
ADP-fossil*	MJ	2,70E+04	9,09E+02	0,00E+00	8,60E+02	1,30E+02	3,53E+02	9,87E+00	-3,11E+03
WDP*	m^3	1,03E+03	2,52E+00	0,00E+00	2,12E+00	1,48E-01	8,75E-01	8,54E-02	-3,41E+00
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

Results per 1 t of unalloyed foundry pig iron									
Indicator	**Unit**	**A1-A3**	**A4**	**A5**	**C1**	**C2**	**C3**	**C4**	**D**
GWP-GHG[1]	kg CO_2 eq.	2,88E+03	5,27E+01	0,00E+00	6,29E+01	1,03E+01	2,08E+01	7,55E-01	-4,08E+02
Particulate matter	Disease incidences	5,02E-05	2,07E-06	0,00E+00	6,77E-06	1,16E-07	4,03E-07	6,67E-08	-1,37E-05
Ionising radiation, human health	kBq U235 eq.	2,08E+01	1,48E+01	0,00E+00	3,89E+00	2,34E-02	5,39E+00	1,16E-02	5,49E+00
Ecotoxicity fresh water	CTUe	3,28E+03	1,82E+02	0,00E+00	2,30E+02	9,55E+01	8,28E+01	6,55E+00	-4,71E+02
Human toxicity, cancer	CTUh	1,42E-06	6,17E-09	0,00E+00	8,05E-08	1,91E-09	2,90E-09	1,34E-10	-6,38E-07
Human toxicity, non-cancer	CTUh	5,06E-06	2,41E-07	0,00E+00	1,98E-07	8,53E-08	8,51E-08	5,19E-09	5,57E-07
Land Use	Pt	9,19E+02	1,26E+02	0,00E+00	1,08E+02	4,75E+01	2,70E+01	2,81E+00	2,84E+02

Resource use indicators

Results per 1 t of unalloyed foundry pig iron									
Indicator	**Unit**	**A1-A3**	**A4**	**A5**	**C1**	**C2**	**C3**	**C4**	**D**
PERE	MJ	5,41E+02	1,21E+02	0,00E+00	4,87E+00	1,10E+01	4,01E+01	1,73E+00	5,42E+02
PERM	MJ	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
PERT	MJ	5,41E+02	1,21E+02	0,00E+00	4,87E+00	1,10E+01	4,01E+01	1,73E+00	5,42E+02
PENRE	MJ	2,70E+04	9,09E+02	0,00E+00	8,60E+02	1,30E+02	3,53E+02	9,87E+00	-3,11E+03
PENRM	MJ	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
PENRT	MJ	2,70E+04	9,09E+02	0,00E+00	8,60E+02	1,30E+02	3,53E+02	9,87E+00	-3,11E+03
SM	kg	3,26E+01	0,00E+00	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	0,00E+00

[1] 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.

NRSF	MJ	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
FW	m^3	3,61E+01	1,67E-01	0,00E+00	4,93E-02	1,23E-02	5,66E-02	2,61E-03	-2,74E-01
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

Results per 1 t of unalloyed foundry pig iron									
Indicator	**Unit**	**A1-A3**	**A4**	**A5**	**C1**	**C2**	**C3**	**C4**	**D**
Hazardous waste disposed	kg	4,51E-03	1,13E-07	0,00E+00	0,00E+00	4,20E-09	4,18E-08	2,48E-09	1,38E-06
Non-hazardous waste disposed	kg	4,21E+00	2,12E-01	0,00E+00	0,00E+00	2,02E-02	8,46E-02	5,00E+01	-6,14E+00
Radioactive waste disposed	kg	2,33E-01	9,91E-02	0,00E+00	0,00E+00	1,68E-04	3,61E-02	1,02E-04	4,91E-02

Output flow indicators

Results per 1 t of unalloyed foundry pig iron									
Indicator	**Unit**	**A1-A3**	**A4**	**A5**	**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	0,00E+00
Material for recycling	kg	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	1,00E+03	0,00E+00	0,00E+00
Materials for energy recovery	kg	2,08E-03	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	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	0,00E+00

References

General Programme Instructions of the International EPD® System. Version 5.0.

Product Category Rules (PCR) document for Construction Products (PCR 2019:14 Version 1.3.4 2024-04-30)

ISO 14020:2000 Environmental labels and declarations — General principles, 2000-09

ISO 14025: EN ISO 14025:2006-11: Environmental labels and declarations - Type III environmental declarations — Principles and procedures

ISO 14040:2006 Environmental management — Life cycle assessment — Principles and framework, 2006-07

ISO 14044:2006 Environmental management — Life cycle assessment — Requirements and guidelines, 2006-07

EN 15804+A2:2019/AC:2021 European Committee for Standardization: Sustainability of construction works – Environmental product declarations – Core rules for the product category of construction products, 2021

Ecoinvent: www.ecoinvent.org, ecoinvent database.

Sphera: software LCA for Experts. 2023, Sphera solutions, www.sphera.com

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