



WEI DAT STEEL WIRE SDN BHD



ENVIRONMENTAL PRODUCT DECLARATION

Galvanized Wire & Innogal

**No. 21, Lorong Bemban 2, Kawasan Perindustrian
Bemban, 31000 Batu Gajah, Perak, Malaysia**

In accordance with ISO 14025 and EN 15804:2012+A2:2019

Program Operator	EPDIItaly
Publisher	EPDIItaly

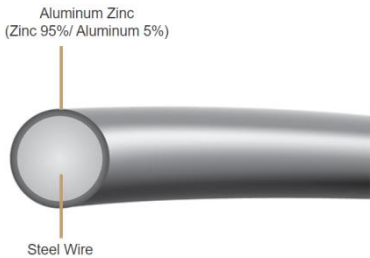
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Galvanized wire



Innogal wire

GENERAL INFORMATION

EPD OWNER	
Name of the company	WEI DAT STEEL WIRE SDN BHD
Registered office	1, Persiaran Perusahaan Kledang Utara 1/5, Kawasan Perindustrian Chandan Raya, Menglembu, 31450 Ipoh, Perak, Malaysia.
Contacts for information on the EPD	YAP LEE SAN<lsyap@weidat.com>,

PROGRAM OPERATOR	
EPDIItaly	Via Gaetano De Castillia n° 10 – 20124 Milano, Italy

INFORMATION ON THE EPD	
Product name (s)	Galvanized wire & Innogal
Site (s)	No. 21, Lorong Bemban 2, Kawasan Perindustrian Bemban, 31000 Batu Gajah, Perak, Malaysia
Short description and technical information of the product (s)	<p>WEIDAT's GP Line Products encompass INNOGAL Wire and Galvanized Wire, both produced on the same production line.</p> <p>GALVANIZED Wire is manufactured by immersing steel wire in molten zinc, creating a thin, durable zinc coating that provides superior corrosion resistance. The process forms a metallurgical bond between the zinc and steel, ensuring long-term protection even in harsh environments.</p> <p>INNOGAL Wire features a 95% zinc and 5% aluminum alloy coating applied through a double-dipping process, forming a protective</p>

	<p>aluminum oxide layer that significantly enhances corrosion resistance and extends the wire's lifespan. This dual-layer protection offers corrosion resistance up to four times greater than standard galvanized wire.</p> <p>INNOGAL Wire also boasts high ductility, allowing for extensive redrawing and severe wire forming operations, making it suitable for a wide range of applications.</p>
Field of application of the product (s)	<p>Both of these Products are widely used across various industries due to their superior corrosion resistance and mechanical properties. Their applications include welded mesh fabric and chain-link fence fabric, providing durable and long-lasting fencing solutions. They are also utilized in the production of barbed wire and gabions, offering enhanced protection and structural integrity in security and erosion control applications. In the poultry and agriculture industries, GP Line Products ensure reliable performance in enclosures and farming structures. Additionally, they serve as critical components in the power cable industry, specifically for armoring cables, where their high strength and corrosion resistance contribute to improved cable durability and protection.</p>
Product (s) reference standards (if any)	<p>BS EN 10244-2: Steel wire and wire products. Non-ferrous metallic coatings on steel wire. Zinc or zinc alloy coatings.</p>
CPC Code (number) https://unstats.un.org/unsd/classifications/Econ	<p>UN CPC 412</p>

VERIFICATION INFORMATION

PCR (title, version, date of publication or update)	<p>CEN standard EN 15804 serves as the Core Product</p> <p>Category Rules (PCR)</p> <p>PCR for Construction products: ICMQ–001/15 rev 3.1 (according to EN 15804+A2).</p> <p>Publication at 12/11/2024</p>
EPDItaly Regulation (version, date of publication or update)	<p>EPDItaly Regulations Rev 6.0</p> <p>Issue date: 30/10/2023</p>
Project Report LCA	<p>LIFE CYCLE ASSESSMENT OF GALVANIZED WIRE FOR ENVIRONMENTAL PRODUCT DECLARATION Version 1.2 of 25.06.2025</p>
Independent Verification Statement	<p>Independent verification of the declaration and data, carried out according to ISO 14025: 2010.</p> <p>Internal <input type="checkbox"/> External <input checked="" type="checkbox"/></p> <p>Third party verification carried out by: ICMQ S.p.A., via Gaetano De Castillia n ° 10 – 20124 Milan, Italy. Accredited by Accredia.</p>
Comparability Statement	<p>Environmental statements published within the same product category, but from different programs, may not be comparable. In particular, EPDs of construction products may not be comparable if they do not comply with EN 15804: 2012 + A2: 2019.</p>
Liability Statement	<p>The EPD Owner releases EPDItaly from any non-compliance with environmental legislation. The holder of the declaration will be responsible for the information and supporting evidence.</p> <p>EPDItaly disclaims any responsibility for the information, data and results provided by the EPD Owner for life cycle assessment.</p>

COMPANY INFORMATION

Description of the organisation

WEIDAT is a leading Malaysian manufacturer specializing in the production of high-quality steel products, including PC Strand, INNOGAL WIRE, and GALVANIZED WIRE. With a strong emphasis on innovation, quality, and sustainability, the company has established itself as a key player in the global steel industry.

Committed to minimizing environmental impact, WEIDAT has integrated sustainable practices throughout its production processes. The company has implemented measures to enhance energy efficiency, optimize material utilization, and reduce industrial waste, contributing to a more resource-efficient and environmentally responsible manufacturing approach.

To further its sustainability objectives, WEIDAT has conducted a Life Cycle Assessment (LCA) to evaluate the environmental performance of its core products. This assessment provides a comprehensive and transparent analysis of the environmental impact associated with the production and use of INNOGALWIRE, and GALVANIZED WIRE. The LCA serves as a foundation for identifying improvement areas, ensuring compliance with international sustainability standards, and supporting WEIDAT's long-term environmental strategy.

	<p>As part of its commitment to transparency and environmental responsibility, WEIDAT aims to publish an Environmental Product Declaration (EPD) for these products on the Italy EPD platform. This third-party verified EPD will provide stakeholders with reliable and standardized environmental data, reinforcing WEIDAT's position as a responsible and forward-thinking industry leader. The publication of the EPD marks a significant milestone in WEIDAT's sustainability journey, aligning its operations with global environmental regulations and market expectations.</p>
Name and location of production site:	No.21, Lorong Bemban 2, Kawasan Perindustrian Bemban, 31000 Batu Gajah, Perak, Malaysia

PRODUCT INFORMATION

Product name:	Galvanized wire & Innogal
Product identification:	Galvanized wire & Innogal are primarily used in prestressed concrete applications.
Product description & features:	<p>WEIDAT's GP Line Products encompass two primary offerings: Galvanized Wire and INNOGAL Wire.</p> <p>Galvanized Wire is produced by coating steel wire with a layer of zinc, providing a protective barrier against environmental elements. This process enhances the wire's resistance to rust and corrosion, making it suitable for various applications where durability and longevity are essential.</p>

Galvanized Wire is widely used in fencing, construction, and agricultural sectors due to its reliability and cost-effectiveness.

INNOGAL Wire is a high-performance steel wire featuring a dual-coating process. Initially, the wire undergoes standard galvanization, followed by immersion in a molten bath comprising 95% zinc and 5% aluminum. This unique coating forms a protective aluminum oxide layer, significantly enhancing the wire's corrosion resistance and extending its lifespan. Even after the zinc/aluminum coating corrodes completely, a further corrosion-resistant Fe/Zn/Al layer forms as aluminum diffuses into the steel, providing continued protection. This dual-layer protection results in corrosion resistance up to four times greater than standard galvanized wire. Additionally, INNOGAL Wire exhibits high ductility, making it suitable for extensive redrawing and severe wire-forming operations, thereby serving as a cost-effective and environmentally friendly alternative to more expensive anti-corrosion materials and coatings.

Products' specifications:

BS EN 10244-2 ●●

INNOGAL WIRE & HEAVY GALVANIZED WIRE

Diameter	Coating Mass
0.15mm-0.20mm	–
0.20mm-0.25mm	30
0.25mm-0.32mm	45
0.32mm-0.40mm	60
0.40mm-0.50mm	85
0.50mm-0.60mm	100
0.60mm-0.70mm	115
0.70mm-0.80mm	130
0.80mm-0.90mm	145
0.90mm-1.00mm	155
1.00mm-1.20mm	165
1.20mm-1.40mm	180
1.40mm-1.65mm	195
1.65mm-1.85mm	205
1.85mm-2.15mm	215
2.15mm-2.50mm	230
2.50mm-2.80mm	245
2.80mm-3.20mm	255
3.20mm-3.80mm	265
3.80mm-4.40mm	275
4.40mm-5.20mm	280
5.20mm-8.20mm	290
8.20mm-10.00mm	300

BS EN 10244-2 ●

STANDARD GALVANIZED WIRE

Diameter	Coating Mass
0.15mm-0.20mm	10
0.20mm-0.50mm	15
0.50mm-0.90mm	20
0.90mm-1.40mm	25
1.40mm-1.85mm	30
1.85mm-2.15mm	40
2.15mm-2.80mm	45
2.80mm-3.20mm	50
3.20mm-4.40mm	60
4.40mm-5.20mm	70
5.20mm-10.00mm	80

BS EN 10244 – 2 ●

INNOGAL/ MID COATED WIRE

Diameter	Coating Mass
0.20mm-0.25mm	20
0.25mm-0.40mm	30
0.40mm-0.50mm	40
0.50mm-0.60mm	50
0.40mm-0.50mm	50
0.60mm-0.80mm	60
0.80mm-1.00mm	70
1.00mm-1.20mm	80
1.20mm-1.40mm	90
1.40mm-1.85mm	100
1.85mm-2.15mm	115
2.15mm-2.80mm	125
2.80mm-4.40mm	135
4.40mm-5.20mm	150
5.20mm-10.00mm	-

GENERAL INFORMATION

LCA information

LCA practitioner: Yuki, Zhao, E-c digital, zhaoyq@ecdigital.com. Zihao Qian, E-c digital, qianzh@ecdigit.com

Declared unit: 1 tonne of Galvanized wire and 1 tonne of Innogal wire.

Time representativeness: Primary data covers a period of 1 July 2023 to 30 June 2024, with all secondary data used <3 years difference to year of study.

Type of EPD: Specific EPD for products with multiple dimensions or formats, covering both Galvanized Wire and Innogal Wire series..

Description of system boundaries: The system boundary of this LCA study covers the cradle to gate stage (A1 to A3) plus end-of-life (C1–C4) and benefits and loads beyond the system boundary (D). Because other life cycle stages are dependent on scenarios and are better developed for specific building or construction works.

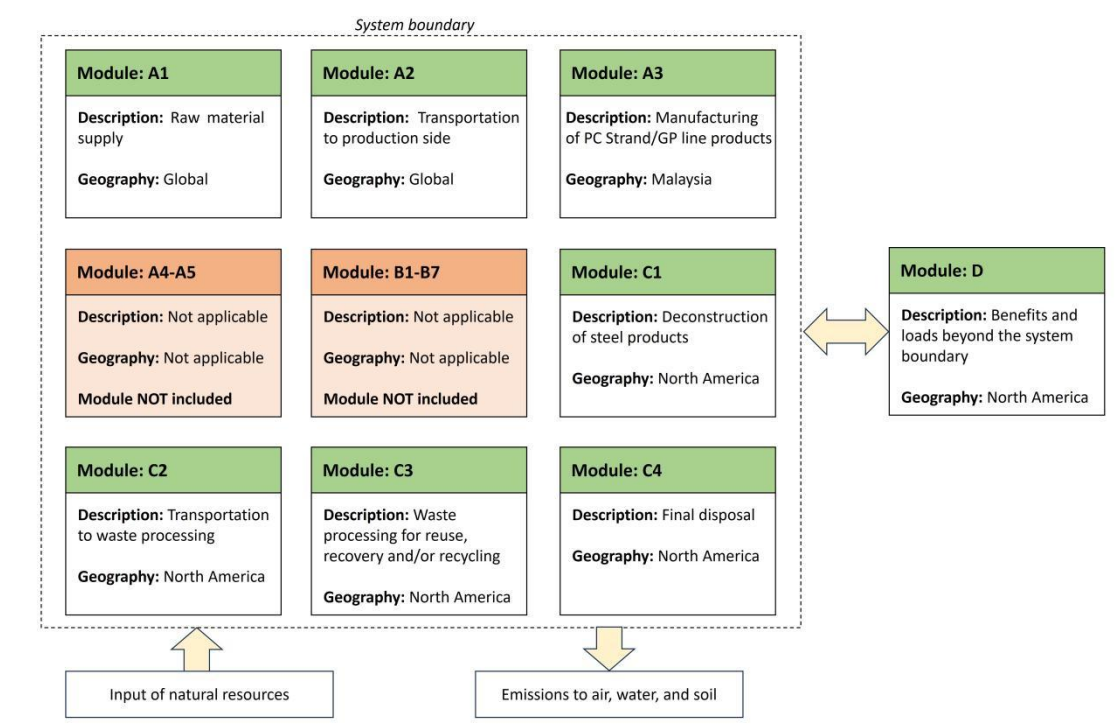


Figure 1: System boundary

Product system description:

The application of the products is as input materials for other industries or processes such as the material of railroad/bridge in the construction process, material for truck frames in the automotive industry, material for Power Cable Industry, etc. The scope of the study comprises a cradle-to-gate life cycle stages with options of modules C1–C4 and module D.

- A1 raw materials supply: This stage includes the production of raw material (wire rods), auxiliary materials (e.g., Chemical etc.,) and electricity (Malaysia’s Grid).
- A2 transportation: According to WEI DAT, most of the raw materials for the production come from all over the world, and the main transportation modes are land trucking and ocean shipping. The distances are estimated by the production site. For suppliers requiring ocean shipments, the on-land transportation distance depends on the port of discharge.
- A3 manufacturing: The manufacturing process (A3) consists of cold drawing, galvanization, cooling, wax coating, and coiling. Besides, there are some supporting processes/utilities i.e., waste water treatment.
- C1–C3 end of life: The disposal of the used products (both galvanized wire & Innogal) will adopt a region average disposal mode following literature review. It is assumed that 24 MJ diesel/ton is required for deconstruction (module C1). A recycling rate of 92% has been assumed for the crude steel product. That is to be seen as the proportion of the material in the product that will be recycled in a subsequent system, and the remaining 8% is assumed to be sent to landfill (Steel Construction Institute, 2012). The steel, which is recovered from the dismantling of steel articles, is assumed to be transported by truck to a recycling yard or waste processing site (module C2). A typical distance of 50 km is used. It was also considered that no further waste processing is needed before disposal, hence no impacts are reported in module C3. End of life disposal treatment process (C4) from Ecoinvent 3.10 database will be used in this LCA study.

Table 1: Scenario and additional technical information of end-of-life stage

Scenario	Parameter	Value	Unit
C1	Energy required for deconstruction, diesel	24	MJ
C2	Transport to waste processing by Truck (lorry EURO 6)	50	km

C3	Background data : treatment of waste reinforcement steel, sorting plant	-	-
C4	Waste for recycling – Recovered steel from crushed concrete	92	%
	Waste for final disposal – sent to landfill	8	%

• D benefits and loads: It is assumed that 92% of the steel used in the structure is recovered for recycling, while the remainder is landfilled. “Benefits and loads beyond the system boundary” (module D) accounts for the environmental benefits and loads resulting from net steel scrap that is used as raw material in the electric arc furnace and that is collected for recycling at end of life. These benefits and loads are calculated by including the burdens of recycling and the benefit of avoided primary production. Low-alloyed steel production using EAF and BOF in Canada from Ecoinvent dataset (to represent North America) will be used in this LCA study. The LCI of input and output data for module D is based on the Ecoinvent database for the production of low-alloyed steel in EAF (secondary steel). External benefits from avoided primary production are calculated based on background data from the database for production of low-alloyed steel in BOF (primary steel). The net scrap approach has been applied towards the metal recycling benefit in module D. Net scrap = Amount of steel recycled at EoL – Scrap input from previous product life cycles. Detailed data is shown in Table 2.

Table 2. Input and output data in module D (for 1 metric ton Galvanized wire & Innogal)

Material/Energy/Waste	Value	Background data	Unit	Region
Input				
Recovered steel (net scrap)	920.000	-	kg	-
Water, cooling, unspecified natural origin	11.146	Water, cooling, unspecified natural origin	m3	Natural resource, in water
aluminium, wrought alloy	1.724	market for aluminium, wrought alloy	kg	GLO
anode, for metal	4.522	market for anode, for metal	kg	GLO

electrolysis		electrolysis		
cast iron	5.979	market for cast iron	kg	GLO
nickel, class 1	3.858	market for nickel, class 1	kg	GLO
molybdenum trioxide	1.642	market for molybdenum trioxide	kg	GLO
ferrosilicon	3.037	market for ferrosilicon	kg	GLO
ferromanganese, high-coal, 74.5% Mn	5.171	market for ferromanganese, high-coal, 74.5% Mn	kg	GLO
ferrochromium, high-carbon, 68% Cr	13.132	market for ferrochromium, high-carbon, 68% Cr	kg	GLO
diesel, burned in building machine	2.841	market for diesel, burned in building machine	MJ	GLO
propane, burned in building machine	2.241	market for propane, burned in building machine	MJ	GLO
heat, district or industrial, natural gas	2008.501	market for heat, district or industrial, natural gas	MJ	CA-QC
hard coal	11.491	market for hard coal	kg	RNA
electricity, medium voltage	618.983	market for electricity, medium voltage	kWh	CA-QC
electricity, low voltage	28.366	market for electricity, low voltage	kWh	CA-QC
argon, liquid	2.701	market for argon, liquid	kg	ROW
refractory, basic, packed	22.563	market for refractory, basic, packed	kg	GLO
quicklime, in pieces, loose	37.033	market for quicklime, in pieces, loose	kg	ROW
oxygen, liquid	5.828	market for oxygen, liquid	kg	ROW
ethylene glycol	0.004	market for ethylene glycol	kg	ROW
electric arc furnace converter	3.283E-08	market for electric arc furnace converter	unit	GLO
Output				

spent solvent mixture	0.004	market for spent solvent mixture	kg	ROW
spent solvent mixture	0.004	market for spent solvent mixture	kg	ROW
electric arc furnace dust	6.958	market for electric arc furnace dust	kg	ROW
inert waste, for final disposal	4.104	market for inert waste, for final disposal	kg	ROW
electric arc furnace slag	181.5	market for electric arc furnace slag	kg	ROW
Steel, low-alloyed, converter (avoided)	-820.777	steel production, converter, low-alloyed	kg	ROW
Carbon dioxide, fossil	34.473	Carbon dioxide, fossil	kg	Air, unspecified
Nitrogen oxides	0.436	Nitrogen oxides	kg	Air, unspecified
Sulfur dioxide	0.063	Sulfur dioxide	kg	Air, unspecified

Goal of study:

The goals of this study are as follows:

- To be able to communicate the environmental performance of WEIDAT's products, WEIDAT is interested in developing an Environmental Product Declaration (EPD) for the following products:
 - GALVANIZED WIRE
 - INNOGAL WIRE
- To conduct LCA following relevant international standards (ISO 14040:2006 and ISO 14044:2006), and Product Category Rules (PCR) for Construction products: ICMQ-001/15 rev 3 (according to EN 15804+A2).
- The LCA study will identify key environmental impact contributors via hotspot analysis, providing a foundation for process improvements in resource efficiency, energy conservation, and emission reduction.
- Establish a baseline LCA model for continuous monitoring and periodic reporting.

Intended use:

This LCA study aims to provide a transparent analysis of the environmental impact of producing and using these products. This assessment is a crucial step in helping the company understand the full environmental footprint of its operations, identify areas for improvement, and align with global sustainability standards.

Allocation:

Allocation refers to the partitioning of input or output flows of a process or product system between the product systems under study and other associated product systems. This study follows the EN 15804 allocation principles as follows:

Avoidance of Allocation

- a. Where possible, allocation should be avoided by dividing unit processes into sub-processes that can be clearly assigned to specific co-products.
- b. When feasible, input and output data should be collected at the sub-process level to ensure accurate allocation.

Physical Relationship-Based Allocation

- a. If a process can be sub-divided but specific data are unavailable, the allocation should be based on physical relationships that define how inputs and outputs change with variations in the product system.

Joint Co-Production Allocation

- a. If a process cannot be sub-divided, allocation should reflect the primary purpose of the process, as declared in official permits or operational goals.
- b. When multiple co-products are generated, allocation follows these rules:
 - a) Mass-based allocation applies when the revenue difference among co-products is \leq 25%.
 - b) Economic allocation applies when the revenue difference exceeds 25%.

- c) Material flows with specific inherent properties (e.g., energy content, biogenic carbon content) should always be allocated based on physical flows, regardless of the allocation approach for the process.

Waste Management Allocation

In this EPD, waste from WEI DAT's GP line production is allocated based on material type and treatment method.

Spent borax and calcium powder are classified as inert waste and disposed of via landfilling. Emissions associated with these streams are allocated based on mass flow, including overhead processes related to landfill operations.

Zinc slag and sludge are sent for appropriate treatment, and their associated emissions are included in the system boundary according to the respective treatment processes.

This allocation approach reflects the actual waste handling and treatment practices implemented at the manufacturing site.

Cut-off criteria:

All available data within the system boundary are included for each unit process. If input data is insufficient or missing for a unit process, the following cut-off criteria apply:

- Any excluded flow shall not exceed 1% of renewable and non-renewable primary energy usage or 1% of the total mass input of that unit process.
- The total of all excluded input flows per module (A1–A3, C1–C4, and D) shall not exceed 5% of total energy usage and mass.
- Missing data will be substituted with proxy or generic data sourced from databases or literature.

This study ensures that all significant data related to unit processes within the system boundary are accounted for.

Data Quality:

Data quality has been assessed and validated during data collection process.

Data quality requirements followed those of ISO 14040/44 and EN 15804. To ensure the quality of data was sufficient data quality checks were completed on key data parameters by 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 summarized as:

- Temporal representativeness: Excellent
- Technological representativeness: Very good
- Geographical representativeness: Very good
- Precision: Very good

Database(s) and LCA software used:

Secondary data are from the Ecoinvent v 3.10, cut-off by classification. The LCA model was developed with "Steel LCA Tool" version 1.2 of 04.06.2025, developed by EC Digital and verified by ICMQ.

Life cycle impact assessment method (LCIA):

This LCA follows the EN15804 PCR guideline and use the recommended impact method for the analysis. LCIA indicators used in this LCA report are based on EF v3.1 method and EN 15804+A2: 2019.

Electricity mix model:

In the A3 stage of WEI DAT's production process, electricity is sourced from both on-site photovoltaic (PV) generation and the Malaysian national grid, accounting for 11.26% and 88.74% of total electricity consumption, respectively.

As part of the LCA assessment, an electricity mix model was created to reflect the actual energy profile used. Based on this model, the calculated GWP emission factor for the electricity mix is 0.759 kg CO₂-eq./kWh. This is derived from the emission factors of 0.843 kg CO₂-eq./kWh for Malaysian grid electricity and 0.088 kg CO₂-eq./kWh for PV electricity.

Table 3 Scope of Declaration in EPD for GP Line Products

Included modules in the life cycle assessment	Product Stage	X	A1	Raw material supply
		X	A2	Transport
		X	A3	Manufacturing
	Construction Stage	MND	A4	Transport from the gate to the site
		MND	A5	Assembly
	Use Stage	MND	B1	Use
		MND	B2	Maintenance
		MND	B3	Repair
		MND	B4	Replacement
		MND	B5	Refurbishment
		MND	B6	Operational energy use
		MND	B7	Operational water use
	End of Life Stage	X	C1	De-construction demolition
		X	C2	Transport
		X	C3	Waste processing
		X	C4	Disposal
Benefits and loads beyond the product system boundary	X	D	Reuse-Recovery-Recycling potential	

Note: X=Declared Module, MND=Module not Declared in this LCA study

Environmental performance:

Table 4 Results of environmental impacts by stage (1 ton GALVANIZED WIRE)

Impact indicators	Unit	Product stage				De– construction demolition	Transport	Waste processing	Disposal	Reuse–Recovery– Recycling potential
		A1	A2	A3	A1–A3	C1	C2	C3	C4	D
<i>GWP</i>	kg CO2 eq	2.67E+03	1.91E+02	1.49E+02	3.01E+03	2.41E+00	9.59E+00	6.03E+01	5.01E–01	–1.31E+00
<i>GWP, f</i>	kg CO2 eq	2.67E+03	1.91E+02	1.49E+02	3.01E+03	2.40E+00	9.58E+00	6.03E+01	5.00E–01	–1.32E+00
<i>GWP, b</i>	kg CO2 eq	4.05E+00	–2.32E– 02	3.74E–01	4.40E+00	2.40E–04	2.90E–05	8.63E–03	5.18E–05	2.22E–03
<i>GWP, luluc</i>	kg CO2 eq	2.03E+00	8.60E–02	4.10E–02	2.16E+00	2.09E–04	3.90E–03	8.45E–03	2.60E–04	7.32E–03
<i>GWP, ghg</i>	kg CO2 eq	2.67E+03	1.91E+02	1.49E+02	3.01E+03	2.40E+00	9.59E+00	6.03E+01	5.01E–01	–1.31E+00
<i>ODP</i>	kg CFC–11 eq	2.20E–05	2.77E–06	2.96E–06	2.78E–05	3.66E–08	1.40E–07	8.93E–07	1.44E–08	–3.35E–09
<i>AP</i>	mol H+ eq	1.12E+01	2.36E+00	2.03E–01	1.37E+01	2.17E–02	2.20E–02	5.34E–01	3.54E–03	2.33E–03
<i>EP, f</i>	kg P eq	1.05E+00	1.17E–02	1.70E–02	1.07E+00	7.00E–05	7.57E–04	2.84E–03	4.15E–05	–3.78E–04

<i>EP, m</i>	kg N eq	2.49E+00	5.82E-01	5.21E-02	3.12E+00	1.01E-02	5.10E-03	2.44E-01	1.35E-03	-9.27E-04
<i>EP, t</i>	mol N eq	2.51E+01	6.45E+00	4.22E-01	3.20E+01	1.10E-01	5.50E-02	2.67E+00	1.47E-02	-9.60E-03
<i>POCP</i>	kg NMVOC eq	8.82E+00	1.94E+00	1.33E-01	1.09E+01	3.29E-02	3.07E-02	7.97E-01	5.28E-03	-2.91E-03
<i>ADPE</i>	kg Sb eq	5.09E-02	4.70E-04	6.08E-04	5.20E-02	8.62E-07	3.20E-05	3.54E-05	7.94E-07	3.63E-05
<i>ADPF</i>	MJ, net calorific value	2.98E+04	2.55E+03	5.23E+02	3.29E+04	3.15E+01	1.35E+02	7.89E+02	1.23E+01	-1.16E+01
<i>WDP</i>	m3 world eq. deprived	1.23E+03	1.00E+01	2.39E+01	1.26E+03	7.70E-02	6.12E-01	2.42E+00	3.43E-02	4.07E-01
<i>PM</i>	Disease incidence	2.28E-04	1.10E-05	2.15E-06	2.42E-04	6.16E-07	7.13E-07	1.49E-05	8.06E-08	-1.10E-07
<i>IRP</i>	kBq U235 eq	9.07E+01	1.79E+00	3.23E+00	9.57E+01	1.41E-02	1.12E-01	6.83E-01	7.82E-03	-2.53E-03
<i>ETP-fw</i>	CTUe	7.01E+04	6.01E+02	3.89E+02	7.11E+04	4.46E+00	3.62E+01	1.15E+02	1.68E+00	-4.68E+01
<i>HTP-c</i>	CTUh	1.57E-04	9.29E-07	5.55E-07	1.58E-04	9.39E-09	5.04E-08	2.31E-07	2.25E-09	-1.43E-07
<i>HTP-nc</i>	CTUh	7.07E-05	1.31E-06	5.79E-07	7.26E-05	4.27E-09	8.69E-08	1.27E-07	2.20E-09	-1.43E-08
<i>SQP</i>	dimensionless	7.70E+03	1.09E+03	1.51E+02	8.94E+03	2.20E+00	8.15E+01	7.25E+01	2.41E+01	-5.02E+00

Table 5 Results of environmental impacts by stage (1 ton INNOGAL)

Impact indicators	Unit	Product stage				De-construction demolition	Transport	Waste processing	Disposal	Reuse-Recovery- Recycling potential
		A1	A2	A3	A1-A3	C1	C2	C3	C4	D
<i>GWP</i>	kg CO2 eq	2.84E+03	1.94E+02	2.84E+02	3.31E+03	2.41E+00	9.59E+00	6.03E+01	5.01E-01	-1.31E+00
<i>GWP, f</i>	kg CO2 eq	2.83E+03	1.94E+02	2.84E+02	3.31E+03	2.40E+00	9.58E+00	6.03E+01	5.00E-01	-1.32E+00
<i>GWP, b</i>	kg CO2 eq	6.20E+00	-2.42E-02	3.85E-01	6.57E+00	2.40E-04	2.90E-05	8.63E-03	5.18E-05	2.22E-03
<i>GWP, luluc</i>	kg CO2 eq	2.27E+00	8.75E-02	4.22E-02	2.40E+00	2.09E-04	3.90E-03	8.45E-03	2.60E-04	7.32E-03
<i>GWP, ghg</i>	kg CO2 eq	2.83E+03	1.94E+02	2.84E+02	3.31E+03	2.40E+00	9.59E+00	6.03E+01	5.01E-01	-1.31E+00
<i>ODP</i>	kg CFC-11 eq	3.29E-05	2.81E-06	2.97E-06	3.86E-05	3.66E-08	1.40E-07	8.93E-07	1.44E-08	-3.35E-09
<i>AP</i>	mol H+ eq	1.26E+01	2.44E+00	2.13E-01	1.52E+01	2.17E-02	2.20E-02	5.34E-01	3.54E-03	2.33E-03
<i>EP, f</i>	kg P eq	1.16E+00	1.18E-02	1.76E-02	1.19E+00	7.00E-05	7.57E-04	2.84E-03	4.15E-05	-3.78E-04
<i>EP, m</i>	kg N eq	2.74E+00	6.03E-01	5.34E-02	3.40E+00	1.01E-02	5.10E-03	2.44E-01	1.35E-03	-9.27E-04

<i>EP, t</i>	mol N eq	2.77E+01	6.67E+00	4.37E-01	3.49E+01	1.10E-01	5.50E-02	2.67E+00	1.47E-02	-9.60E-03
<i>POCP</i>	kg NMVOC eq	9.65E+00	2.01E+00	1.38E-01	1.18E+01	3.29E-02	3.07E-02	7.97E-01	5.28E-03	-2.91E-03
<i>ADPE</i>	kg Sb eq	8.41E-02	4.72E-04	6.67E-04	8.53E-02	8.62E-07	3.20E-05	3.54E-05	7.94E-07	3.63E-05
<i>ADPF</i>	MJ, net calorific value	3.41E+04	2.59E+03	5.37E+02	3.72E+04	3.15E+01	1.35E+02	7.89E+02	1.23E+01	-1.16E+01
<i>WDP</i>	m3 world eq. deprived	1.32E+03	1.01E+01	2.42E+01	1.35E+03	7.70E-02	6.12E-01	2.42E+00	3.43E-02	4.07E-01
<i>PM</i>	Disease incidence	2.36E-04	1.11E-05	2.32E-06	2.49E-04	6.16E-07	7.13E-07	1.49E-05	8.06E-08	-1.10E-07
<i>IRP</i>	kBq U235 eq	1.09E+02	1.81E+00	3.30E+00	1.14E+02	1.41E-02	1.12E-01	6.83E-01	7.82E-03	-2.53E-03
<i>ETP-fw</i>	CTUe	7.97E+04	6.07E+02	4.02E+02	8.07E+04	4.46E+00	3.62E+01	1.15E+02	1.68E+00	-4.68E+01
<i>HTP-c</i>	CTUh	1.58E-04	9.40E-07	5.67E-07	1.59E-04	9.39E-09	5.04E-08	2.31E-07	2.25E-09	-1.43E-07
<i>HTP-nc</i>	CTUh	7.84E-05	1.32E-06	6.33E-07	8.04E-05	4.27E-09	8.69E-08	1.27E-07	2.20E-09	-1.43E-08
<i>SQP</i>	dimensionless	8.26E+03	1.09E+03	1.66E+02	9.52E+03	2.20E+00	8.15E+01	7.25E+01	2.41E+01	-5.02E+00

Noted:

For the indicators **ADPE, ADPF, and WDP**, the results should be interpreted with caution, as they are subject to a high level of uncertainty or there is limited experience in their application.

Acronyms

<i>GWP</i>	Climate change: global warming potential, total (GWP100)	<i>POCP</i>	Formation potential of tropospheric ozone
<i>GWP, b</i>	Climate change: global warming potential, biogenic (GWP100)	<i>ADPE</i>	Abiotic depletion potential for non-fossil resources: minerals & metals
<i>GWP, f</i>	Climate change: global warming potential, fossil (GWP100)	<i>ADPF</i>	Abiotic depletion potential for fossil resources
<i>GWP, ghg</i>	Climate change: global warming potential, excluding biogenic uptake, emission and storage (GWP100)	<i>WDP</i>	Water (user) deprivation potential, deprivation-weighted water consumption
<i>GWP, luluc</i>	Climate change: land use and land use change-global warming potential (GWP100)	<i>PM</i>	Potential incidence of disease due to PM emissions
<i>ODP</i>	Ozone depletion potential	<i>IRP</i>	Ionizing radiation, potential human exposure efficiency relative to U235
<i>AP</i>	Acidification potential, Accumulate Exceedance	<i>ETP_{fw}</i>	Potential comparative toxic unit for ecosystems: fresh water
<i>EP, f</i>	Eutrophication potential, fraction of nutrients reaching freshwater end compartment	<i>HTP_c</i>	Potential comparative toxic unit for humans: cancer effects

<i>RSF</i>	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	0.00E+00
<i>NRSF</i>	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	0.00E+00
<i>FW</i>	m3	0.00E+00	0.00E+00	6.66E-01	6.66E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Acronyms

<i>PERE</i>	Use of renewable primary energy excluding renewable primary energy resources used as raw materials	<i>PENRT</i>	Total use of non-renewable primary energy resources
<i>PERM</i>	Use of renewable primary energy resources used as raw materials	<i>SM</i>	Use of secondary raw materials
<i>PERT</i>	Total use of renewable primary energy resources	<i>RSF</i>	Use of renewable secondary fuels
<i>PENR</i>	Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials	<i>NRSF</i>	Use of non-renewable secondary fuels
<i>PENRM</i>	Use of non-renewable primary energy resources used as raw materials	<i>FW</i>	Use of net fresh water

Table 8 Results of output flows and waste categories by stage (1 ton GALVANIZED WIRE)

Impact indicators	Unit		De-construction demolition	Transport	Waste processing	Disposal	Reuse-Recovery-Recycling potential
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		A1	A2	A3	A1-A3	C1	C2	C3	C4	D
<i>HWD</i>	kg	8.85E+02	0.00E+00	5.20E+00	8.90E+02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.88E+02
<i>NHWD</i>	kg	1.21E+04	0.00E+00	4.51E+00	1.21E+04	0.00E+00	0.00E+00	0.00E+00	8.00E-02	4.10E+00
<i>RWD</i>	kg	2.43E-02	0.00E+00	0.00E+00	2.43E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
<i>CRU</i>	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	0.00E+00
<i>MFR</i>	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	9.20E-01	0.00E+00	0.00E+00
<i>MER</i>	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	0.00E+00
<i>EEE</i>	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	0.00E+00
<i>EEH</i>	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	0.00E+00

Table 9 Results of output flows and waste categories by stage (1 ton INNOGAL)

Impact indicators	Unit	Product stage				De-construction demolition	Transport	Waste processing	Disposal	Reuse-Recovery-Recycling potential
		A1	A2	A3	A1-A3	C1	C2	C3	C4	D

<i>HWD</i>	kg	8.85E+02	0.00E+00	5.20E+00	8.90E+02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.88E+02
<i>NHWD</i>	kg	1.21E+04	0.00E+00	4.51E+00	1.21E+04	0.00E+00	0.00E+00	0.00E+00	8.00E-02	4.10E+00
<i>RWD</i>	kg	2.43E-02	0.00E+00	0.00E+00	2.43E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
<i>CRU</i>	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	0.00E+00
<i>MFR</i>	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	9.20E-01	0.00E+00	0.00E+00
<i>MER</i>	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	0.00E+00
<i>EEE</i>	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	0.00E+00
<i>EEH</i>	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	0.00E+00

Acronyms

<i>HWD</i>	Hazardous waste disposed	<i>MFR</i>	Materials for recycling
<i>NHWD</i>	Non-hazardous waste disposed	<i>MER</i>	Materials for energy recovery
<i>RWD</i>	Radioactive waste disposed	<i>EEE</i>	Exported energy, electricity
<i>CRU</i>	Components for re-use	<i>EEH</i>	Exported energy, heat

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5. ISO 14040:2021

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6. ISO 14044:2021

Environmental management – Life cycle assessment – Requirements and guidelines.

7. ISO 14046:2014

Environmental management – Water footprint – Principles, requirements and guidelines.

8. ISO 14067:2018

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