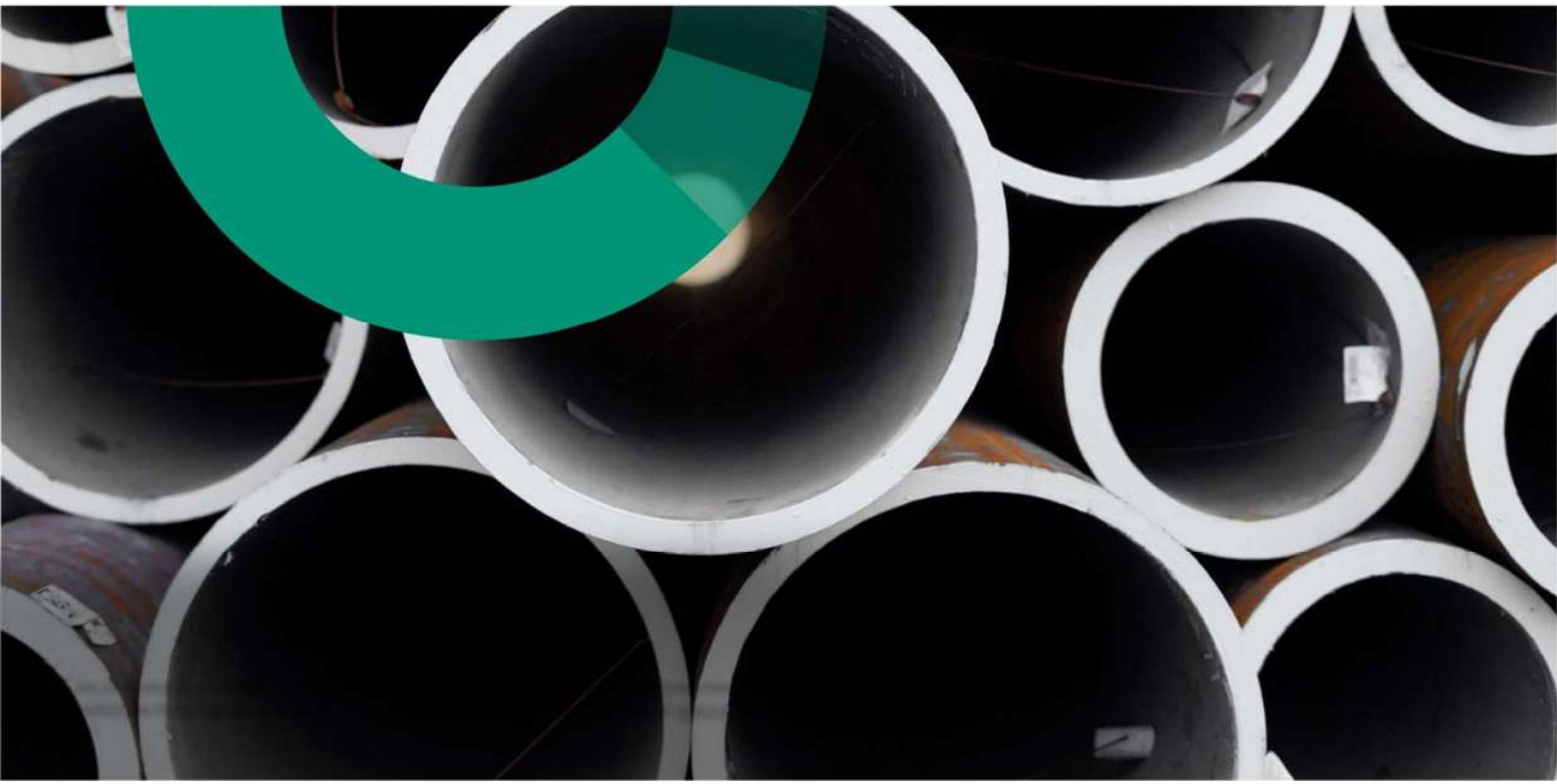
Life Cycle Analysis

In accordance with ISO14040:2006 and ISO 14044:2006

TUBOS REUNIDOS GROUP

O-Next SEAMLESS STEEL TUBES FOR MECHANICAL, INDUSTRIAL AND STRUCTURAL APPLICATIONS

REV 0 JANUARY 25



CONTACT DETAILS

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www.tubosreunidosgroup.com

Geographical scope: Spain

DESCRIPTION OF THE ORGANISATION

Next Generation Tubes

We develop and produce seamless steel tubes with special and complex requirements, designed and tailor-made for each and every customer in stainless steel as well as in high alloys, carbon grades and in Special finishings.

We meet and even exceed all the industrial processes and requirements of the energy sector (bioenergy, solar, wind, CCUS, hydrogen...), and we are also present in other sectors such as handling and lifting machinery, mobility and other industrial mechanical applications.

Our international presence in more than 100 countries and our vocation for excellence in service allows us to be closer to the needs of each client. We also combine 130 years of experience with an outstanding desire for innovation in products as well as in flexible and in integrated processes and management.

We are committed to sustainable development and work towards reducing our environmental footprint and to boosting our process circularity while providing solutions aimed to promote projects for the transition towards a decarbonized economy.

TUBOS Mill (Amurrio site)

Manufactures hot-rolled and cold-drawn seamless carbon and alloy steel tubes up to 13% Cr., for Energy industries like Oil&Gas, Petrochemical, Chemical, Power generation and energy transition industries as Hydrogen, CCUS, Biothermal, Biofuels. As well as other applications like Mobility, Construction and Mechanical Engineering.

Range of products

- **Hot rolled**, 26,7 mm to 180 mm in Ø and up to 25,1 m in length.
- **Cold drawn**, 15 mm to 118 mm in Ø and up to 20,1 m in length.

We also provide special finishing operations / conditions as: "U" bent, studded, finned tubes, coatings, etc.

PRODUCTOS Mill (Sestao - Trápaga site)

Manufactures stainless, alloy and carbon steel seamless tubes.

We are manufacturers of Hot rolled Seamless Steel Tubes specialized in big sizes and heavy wall, mainly for structural and mechanical engineering, oil and gas, hydrogen, powergen, refineries, chemical, petrochemical and fertilizer plants, nuclear, offshore wind, among other.

Range of products

- **Outside diameter**, 193 mm - 711 mm. 7 1⁄2 " - 28"
- **Wall Thickness**, 6,35 mm - 125 mm. 1/4 " - 5"

Our International Network

3
R&D Centres

6
Countries with Sales Office

14
Countries with Sales Agency

Our Markets

ENERGY

- Bioenergy
- Hydrogen
- Nuclear
- Carbon Capture
- Geothermal
- Oil & Gas

INDUSTRY

- Offshore Wind
- Solar
- Construction
- Mobility
- Engineering

Product information

PRODUCT NAME

O-Next –Seamless Carbon Steel Tubes and Pipes for Mechanical, Industrial and Structural applications

PRODUCT IDENTIFICATION

Seamless carbon steel tubes and pipes.

PRODUCT DESCRIPTION

This LCA describes the seamless carbon steel tubes for mechanical, industrial and structural purposes produced by TRG with renewables energy.

The product corresponds to a carbon steel tube cast in ingot molds, seamless, hot-rolled and with an electric furnace normalizing process. It covers the tubes for mechanical and structural purposes. These tubes may also have more general-purpose applications.

O-Next Seamless Steel Tubes and Pipes are produced with recycled raw materials and fossil free energy.

The technical characteristics of the products are according to the following standards:

- EN 10025 Hot rolled products of structural steels - Part 2: Technical delivery conditions for non-alloy structural steels.
- EN 10210-1/-2 Hot rolled products of structural steels - Part 2: Technical delivery conditions for non-alloy structural steels.
- EN 10216-3 Seamless steel tubes for pressure purposes - Technical delivery conditions - Part 3: Alloy fine grain steel tubes.
- EN 10225 Gas welding equipment - Marking for equipment used for gas welding, cutting and allied processes.
- EN 10225-3 Weldable structural steels for fixed offshore structures - Technical delivery conditions - Part 3: Hot finished hollow sections.
- EN 10297 Seamless circular steel tubes for mechanical and general engineering purposes - Technical delivery conditions - Part 1: Non-alloy and alloy steel tubes.

CONSTRUCTIONAL DATA

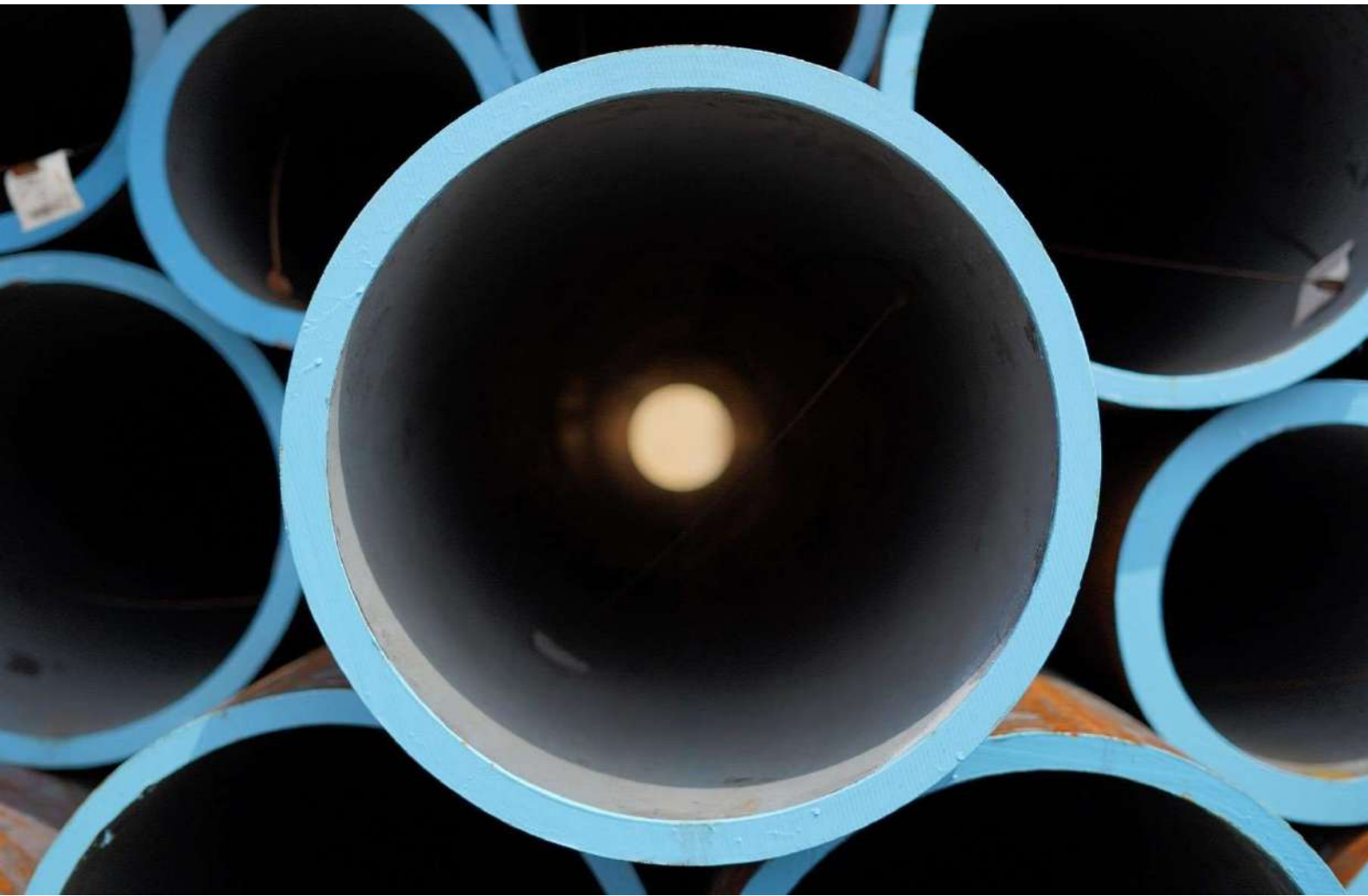
NAME	VALUE	UNIT
Yield strength at room temperature (min)	355*	N/mm^2
Tensile strength at room temperature	450 - 680	N/mm^2
Elongation at room temperature (min)	22	%
Minimum average absorbed energy	27	Joule 20°C

*For wall thickness below 16"

Next Generation Tubes

OUTSIDE DIAMETER	WALL THICKNESS	GRADE	
8”-28”	0,5”-5”	**EN 10025**	S355J2G3 | S355JR
		EN10216-3	P355N | P355NH | P355NL1 | P355NL2
		EN10210-1-2	S355H0H | S355JH2 | S355K2H | S355NH | S355NLH
		EN10225	S355G14 | S355G15
		EN10225-3	S355NHHO | S355NLHHO
		EN10297	E355K2

UN CPC code: 4128 - Tube, pipes and hollow profiles of steel



LCA information

DECLARED UNIT

1 ton (1000 kg) of fabricated tube

TIME REPRESENTATIVENESS

Primary data originated by TRG, corresponds to the year 2022.

The declared unit of "1 ton (1000 kg) of fabricated tube" has been calculated having into account all the annual inputs and outputs of the manufacturing process in the plants of Sestao (steel mill) and Trapaga (rolling mill). This production represents a quality of tube with a specific path of manufacturing steps, which are inventoried in the Core of the present study.

DATABASE(S) AND LCA SOFTWARE USED

The database used was Ecoinvent 3.9 and the software used was SIMAPRO 9.5.01.

DESCRIPTION OF SYSTEM BOUNDARIES

The system boundaries established in this study have been defined following the guidelines of the PCR 2023:01 Fabricated Metal products, applying the "cradle-to-gate" criterion.

SYSTEM DIAGRAM

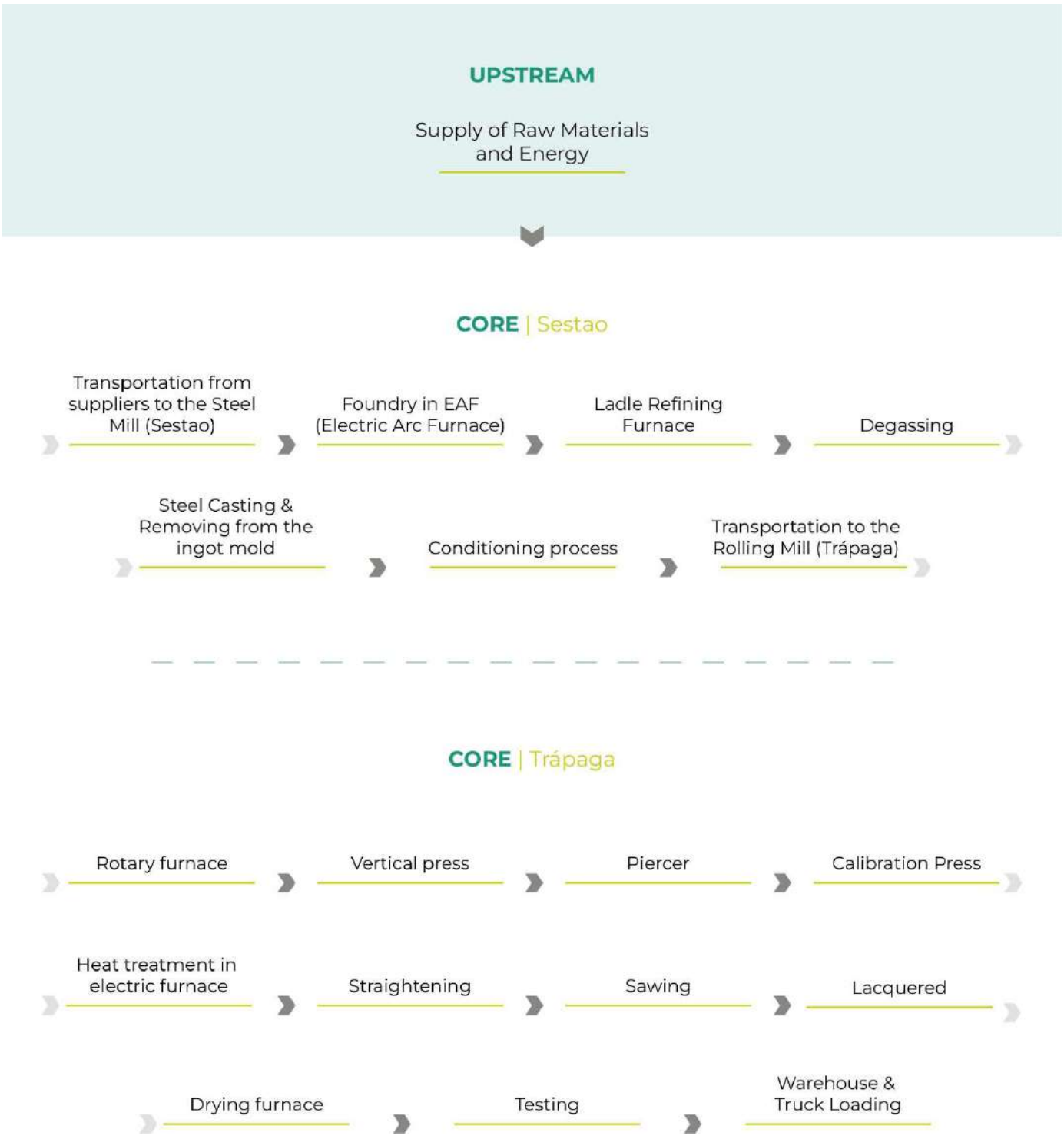
The scope of life cycle of assessment (LCA) is cradle-to-gate, and therefore, this study includes the information from the Upstream and Core stages.

UPSTREAM

- Extraction and production of raw material for all main parts of the product.
- Recycling process of recycled material used in the product.
- Transportation of raw material to the upstream process (default information included in the indicators used).
- Generation of electricity and production of fuel (default information included in the indicators used).

CORE

- Manufacturing process; including the inflow of auxiliary materials and energy consumptions needed for the manufacturing of the product. The manufacturing process includes the use of 100% renewable electricity and biogas.
- Transportation of the steel raw materials and other materials and components to the core process where the final manufacturing takes place.
- End-of-life treatment of manufacturing waste.
- Generation of electricity and production fuels, steam and other energy carries used.



Excluded Lifecycle Stages

The Downstream phase has not been included as the scope used for the study is “cradle-to-gate”; therefore, the transportation of the tube to the retailer/consumer, the use and the end-of-life of the product have not been included.

The tubes are not packaged for its delivery, and therefore no packaging was included in the study.

Additional technical information

General Manufacturing Specification

STEEL PRODUCTION

The steel used by TRG is produced in our own steel shops and comes from the melt of high-quality scrap; we have an electric process with EAF. From the furnace, the steel is transported to a ladle furnace and also a vacuum degasser to obtain the ingot bars that feed the rolling facility. The steel is produced in Sestao and the ingots are transported to Trápaga, which is 1,5 km far.

ROLLING FACILITY

The ingots get to the furnace to achieve the appropriate temperature to follow the process: vertical press, piercer and pilgering. After passing through the calibration press, we obtain the thickness rolling and diameter sizing in order to obtain the desired final dimensions.

HEAT TREATMENTS

We are working in the effectiveness of our heat treatments before the finishing lines in order to improve day by day the performance of our tubes and to be stronger in our way to a better sustainable process with less emissions, less consumptions and higher efficiency.

The heat treatment process is continually being improved, to meet the needs of the clients, to walk with them in their energy transition through innovative and sustainable tubular solutions.

FINISHING AND PACKING

The electricity used for production is 100% renewable electricity from guaranteed renewable sources from Iberdrola.

Content declaration

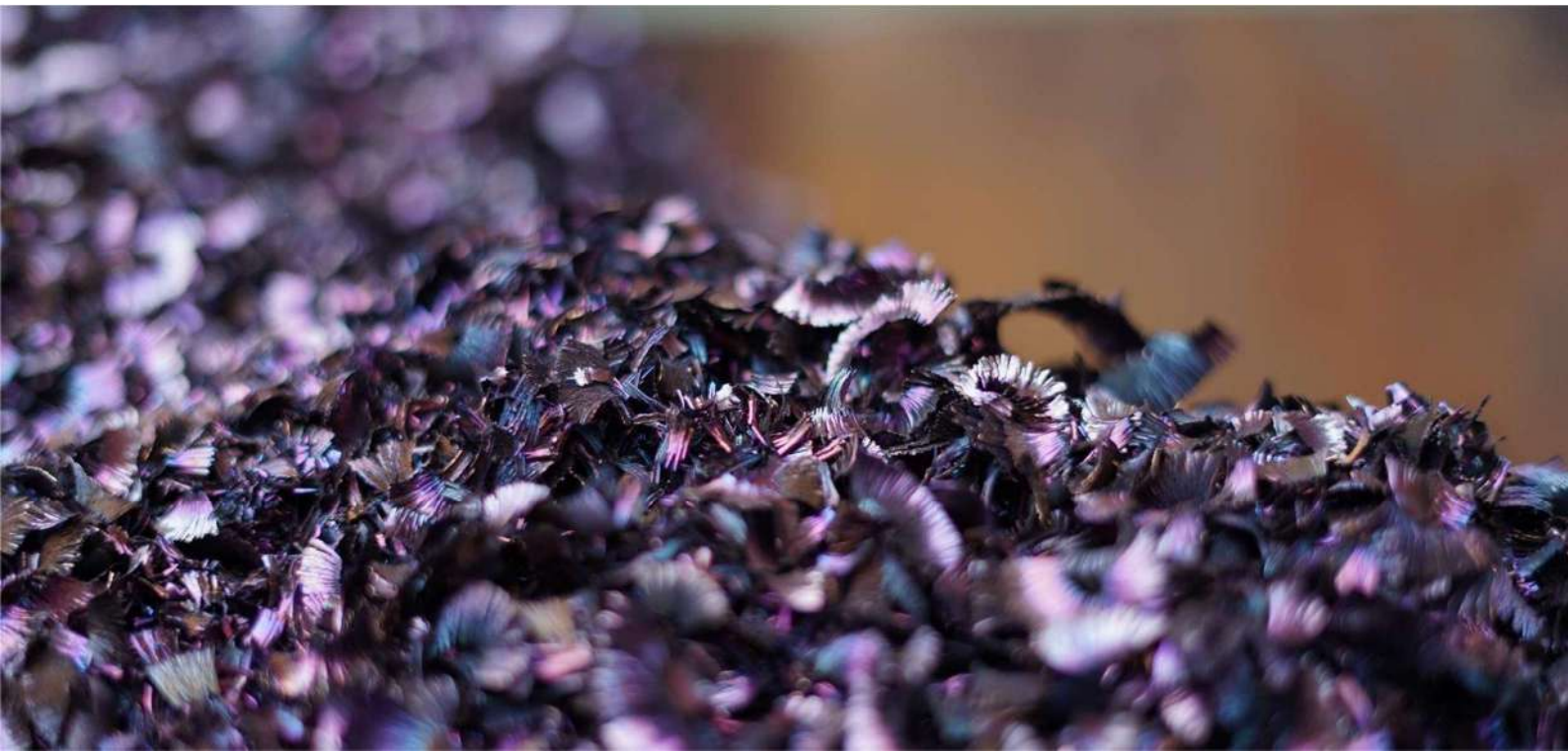
The tube is made from 100% steel, with following chemical composition:

PRODUCT COMPONENT	SYMBOL		WT
CARBON	C	%	0,13 - 0,18
MANGANESE	Mn	%	1,45 - 1,55
SILICON	Si	%	0,15 - 0,40
PHOSPHORUS	P	%	< 0,03
SULPHUR	S	%	< 0,01
CHROMIUM	Cr	%	< 0,30
NICKEL	Ni	%	< 0,50
MOLYBDENUM	Mo	%	< 0,08
VANADIUM	V	%	0,05 - 0,07
ALUMINIUM	Al	%	0,02 - 0,03
TITANIUM	Ti	%	< 0,01
NIOBIUM	Nb	%	< 0,03
CUPPER	Cu	%	< 0,30
TIN	Sn	%	< 0,03
NITROGEN	N	ppm	120
Ce	C.E.	%	< 0,50
Cr+Cu+Mo		%	< 0,45
Nb+Ti+V		%	< 0,12

The product does not contain, or release substances classified as hazardous according to Regulation (EC) No. 1907/2006 (REACH), and no component of the product is classified as hazardous according to Regulation (EC) No. 1272/2008 (CLP).

RECYCLED MATERIAL

TRG uses scrap steel as a raw material for this product, and the content of recycled material is 91,73%.



Results of the environmental performance indicators

IMPACT CATEGORY INDICATORS

Results for the life cycle assessment per declared unit: "1 ton (1000 kg) of fabricated tube"

ENVIRONMENTAL IMPACT	UNIT	UPSTREAM	CORE	TOTAL
Global warming potential (GWP) - Fossil	kg CO2 eq	1,71E+02	3,30E+02	5,01E+02
Global Warming Potential (GWP) - Biogenic	kg CO2 eq	2,26E-01	3,64E+00	3,86E+00
Global warming potential (GWP) - Land use	kg CO2 eq	3,03E-01	4,59E+00	4,89E+00
Global warming potential (GWP) - Total	**kg CO2 eq**	**1,72E+02**	**3,38E+02**	**5,09E+02**
Acidification (AP)	mol H+ eq	1,40E+00	1,60E+00	3,00E+00
Eutrophication (EP), freshwater	kg P eq	7,87E-03	1,38E-02	2,17E-02
Eutrophication (EP), marine	kg N eq	2,98E-01	3,48E-01	6,46E-01
Eutrophication (EP), terrestrial	mol N eq	3,36E+00	4,06E+00	7,43E+00
Photochemical ozone creation potential (POCP)	kg NMVOC eq	1,02E+00	1,32E+00	2,34E+00
Ozone depletion (ODP)	kg CFC-11 eq	1,90E-06	8,92E-06	1,08E-05
Abiotic depletion potential (ADP) - minerals and metals	kg Sb eq	3,00E-03	2,55E-03	5,55E-03
Abiotic depletion potential (ADP)- fossil fuels	MJ	2,06E+03	4,44E+03	6,49E+03
Water deprivation potential (WDP)	m3 eq depriv.	2,09E+01	3,84E+02	4,05E+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*

The results for the Total Global Warming Potential (GWP) impact for 1 ton of fabricated tube are:

ENVIRONMENTAL IMPACT	UPSTREAM	CORE	TOTAL
Global warming potential (GWP) - Total	**171,74**	**337,74**	**509,48**
Climate warming potential (GWP) - Total (%)	33,7%	66,3%	100%

The total Global warming potential of 1 ton of fabricated tube is 509,48 kg CO2 eq.

RESOURCE USE INDICATORS

PARAMETER		UNIT	UPSTREAM	CORE	TOTAL
Primary energy resources – Renewable	Use as energy carrier	MJ, net calorific value	3,99E+02	6,25E+03	6,64E+03
	Used as raw materials	MJ, net calorific value	0,00E+00	0,00E+00	0,00E+00
	TOTAL	**MJ, net calorific value**	**3,99E+02**	**6,25E+02**	**6,64E+03**
Primary energy resources – Non-renewable	Use as energy carrier	MJ, net calorific value	2,06E+03	4,44E+03	6,49E+03
	Used as raw materials	MJ, net calorific value	0,00E+00	0,00E+00	0,00E+00
	TOTAL	MJ, net calorific value	2,06E+03	4,44E+03	6,49E+03

References

- TRG: https://www.tubosreunidosgroup.com/es/home
- ISO 14040:2006. Environmental management — Life cycle assessment — Principles and framework.
- ISO 14044:2006. Environmental management — Life cycle assessment — Requirements and guidelines.
- ISO 14025:2006: Environmental labels and declarations. Type III environmental declarations. Principles and procedures.
- Product Category Rules (PCR) 2023:01 Version 1.0.2: Fabricated Metal Products, Except Construction Products: UN CPC 4128 – Tubes, pipes and hollow profiles of steel

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