Programme

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Geographical scope

Environmental Product Declaration

(OCTG) Oil Country Tubular Goods

In accordance with ISO 14025:2006

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 <u>www.environdec.com</u>





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Program related information



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Accountabilities for PCR, LCA and third-party verification

Product Category Rules (PCR)

PCR 2023:01 v.1.0 "Fabricated metal products, except construction products". EPD System. Date 2023-01-06. Valid until 2027-01-0 6

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: Claudia A. Peña, University of Concepción, Chile. The review panel may be contacted via the Secretariat www.environdec.com/contact.



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Independent third-party verification of the declaration and data, according to ISO 14025:2006, via: EPD verification by accredited certification body

EUROCERT is an approved certification body accountable for third-party verification The certification body is accredited by: Hellenic Accreditation System SA (E.S.Y.D), Accreditation No. 21-8

Procedure for follow-up during EPD validity involves third party verifier

🛛 Yes □ No



Company Information

At a glance

Corinth Pipeworks is one of the leading manufacturers of steel pipes and hollow sections, worldwide, for the energy and construction sectors.

With a successful course and experience of over half a century, it has implemented very demanding projects with leading energy companies worldwide.

We are ready for the energy transition, we are committed to contributing positively to the energy transition and tackling climate change through new technological solutions that allow the increasing use of renewable sources in the energy mix, through the development of innovative products and reducing our carbon footprint. With over half a century of experience, Corinth Pipeworks has collaborated with major energy companies around the world, in extremely demanding projects.

The customer-centric philosophy of the Company has brought about strong, long-term and mutually beneficial relationships, strengthening its geographical presence. The plant is located in the Industrial Area of Thisvi in the Prefecture



of Viotia, Greece and is considered to be one of the most modern steel pipe manufacturing mills, worldwide. For Corinth Pipeworks product quality assurance is a matter for all those involved in the process. It capitalizes the active participation of the management, the employees, the suppliers and even the customers and creates a sense of trust among shareholders. The company's Quality policy includes all those methods and practices that ensure product quality throughout the value chain from design to steel production, investment, storage and disposal. Top Management is committed to Quality, therefore provides the necessary resources for the continual improvement of the Quality Management System, which conforms to the requirements of ISO 9001 & API Q1 standards. It also includes the collection and evaluation process of information on customer satisfaction in order to constantly improve the methods and practices that follow.

The Company manufactures one of the most complete product ranges in the world and offers complete solutions, which are based on investments in new technologies and the continuous improvement of its production processes.





Product Information

This is a specific EPD for Steel Oil Country Tubular Goods (OCTG) produced by Corinth Pipeworks in Thisvi plant.

Oil country tubular goods (OCTG) is a family of products consisting of, casing and tubing for use in all type of drilling application in Oil & Gas sector. We meet this challenge together with our customers by offering a wide range of high-quality Casing & Conductor pipes, for use in all types of oil and gas drilling and well completion activities for both onshore and offshore exploration and production. CPW's core range in casing pipes is based in the unique capabilities of our 26" HFW mill. combined with our new 56" LSAW mill casing and conductor pipes can be supplied from grades J55 PSL1 API 5CT up to X80M in 20.62mm PSL2 API 5L (HFW) and from API5L GrB up to X70M in 38.1mm PSL2 API 5L (LSAW). CPW's Thisvi deep water sea port within 1.5km distance from the mill, ensures high operating efficiency, reduced handling costs and improved delivery times. CPW's Oil country tubular goods (OCTG) are coated with varnish.

Material	OCTG
Steel	> 99%
Varnish	<1%

Composition ranges for Corinth Pipeworks products

No substance in the "Candidate List of Substances of Very High Concern (SVHC) for authorization" exceeds 0.1% wt in the final products.

System Boundaries

The scope of the study is set to be Cradle-to-gate. The systems boundaries are strictly referred to the manufacturing plant of Thisvi and described in more detail below:

Upstream processes

Upstream processes include:

- Extraction and production of raw material for all main parts and components of the product.
- Transportation of raw material to the upstream processes.
- Generation of electricity and production of fuels, steam and other energy carriers used in upstream processes.

Core processes

Core processes include:

• Transportation of steel and other materials and components to the core process where the final steel product will be manufactured.

- Manufacturing process. Manufacturing of steel OCTG includes:
 - Casting
 - Welding/shape configuration
 - Varnish coating
 - Final testing
- End-of-life treatment of manufacturing waste, even if carried out by third parties, including transportation
- Generation of electricity and production of fuels, steam and other energy carriers used in core processes.





Upstream processes	Raw materials production (steel coils, varnish)
Core processes	Transportation of raw materials to manufacturing site
	Fuels & Energy production & Transmission
	Manufacturing stage Casting Welding/Shape configuration Varnish coating Testing
	Manufacturing waste treatment

Schematics of the equipment and of the steps of the production are shown below:



System boundary towards nature

Corinth Pipeworks S.A manufacturing plant is placed in the Industrial Zone of Thisvi, Viotia Greece. The exact geographical coordinates of the plant is 38.23463448912686, 22.954339833150314).

System boundary towards other technical systems

Boundaries towards other technical systems define the flow of materials and components to/from the product system under study and from/to other product systems. In this case, steel and oils wastes are generated through the manufacturing process and considered as output waste flows, so their treatment until they reach the end-of-waste state is taken into account.





LCA Information



Declared unit

The declared unit is 1 metric ton of OCTG. Bare OCTG and varnish coated OCTG have a minor difference in GWP indicator (under 0,3%). Thus, as 'worst case scenario', the results of 1 ton of varnished OCTG production are presented.



Goal and Scope

This EPD evaluates the environmental impacts of the production of 1 ton of OCTG from Cradle to gate (upstream and core processes).



System Boundaries

The system boundaries are set to be cradle to gate, including upstream and core processes.



Cut-off rules

According to PCR 2023:01 "Fabricated metal products, except construction products", a cut-off rule of 1% shall be applied. In other words, the included inventory data (not including inventory data of processes that are explicitly outside the system boundary) shall together give rise to at least 99% of the results of any of the environmental impact categories. Also, 99% of the mass of the product content and 99% of the energy use of the product life cycle shall be accounted for. The cut-off of inventory data should, however, be avoided, and all available inventory data shall be used. In this case, cut-off criteria were applied to some wastes generated through the manufacturing process, such as filters and unspecified materials for recycling and disposal and in electricity used for other utilities, e.g. offices.



Allocations

Allocation rules have been performed in accordance with the requirements of ISO 14044:2006 and PCR 2023:01. Allocation can be divided into allocation of co-products, i.e. allocation of unit processes that generate several products, and allocation of waste, i.e. allocation of unit processes that generate materials that are, for example, landfilled recovered, recycled or reused, and which require further processing to cease being waste and become products. Allocation shall be avoided, if possible, by dividing the process to be allocated into sub-processes and collecting the inventory data for each sub-process. If allocation cannot be avoided, the inventory data should be partitioned between the different co-products in a way that reflects the underlying physical relationships between them, i.e. allocation should reflect the way in which the inventory data changes if the quantities of delivered co-products change.

In this case, allocation was applied in wastes and water consumed through the manufacturing process, based on the total mass of manufactured products of Corinth Pipeworks for 2022.



LCA Information



Assumptions & data quality

For raw materials transportation, a EURO5 lorry 16-32 metric ton was utilized for road transportation and a bulk carrier for dry goods for sea transportation. ISO 14044 was applied in terms of data collection and quality requirements. The impact of the production of raw materials recovered from Ecoinvent database v.3.9.1. The data concerning all upstream and core processes were provided by Corinth Pipeworks S.A. and they were extracted from the company's SAP system, production files and invoices. Distances from the suppliers are obtained from Eco transit. For the amount of electricity and diesel required for OCTG production, the following assumption has been made:

 OCTG are produced in two different lines that produce also other products (HSAW pipes, LSAW pipes, hollow sections). Thus, electricity and diesel during time periods where exclusively OCTG are produced are utilized, so that a specific electricity (kWh/ton) and diesel consumption (lt/ton) is calculated.

Regarding electricity mix, the latest (2021) national residual electricity mix as published in DAPEEP SA was utilized. The emission factor for diesel is provided from National Inventory Report of 2022 for Greece. Background data for these stages are retrieved from Ecoinvent v.3.9.1.

All generic data used in the assessment was sourced from Ecoinvent V.3.9.1 database which is valid for 2022. The selection of the datasets was held in order to be the more representative with regard to the geographical scope, technology and time. In the cases where a specific dataset is missing from the database, a similar dataset was chosen. There are no data gaps observed in the acquisition of data. The representativeness of the data is assessed to be better than $\pm 5\%$, in terms of the environmental impact calculated on the basis of the data, of data that is fully representative for the given temporal, technological and geographical context.



Geographical Scope



Time representativeness

Data obtained refers to the year 2022.



Software used

OpenLCA v.1.11.0

Worldwide





Environmental Perfomance

Varnished OCTG Oil Country Tubular Goods

	Unit	Upstream	Core	Total
GWP-Fossil	kg CO2 eq	2,64E+03	1,38E+02	2,78E+03
GWP-Biogenic	kg CO2 eq	2,18E+00	1,99E-01	2,38E+00
GWP-luluc	kg CO2 eq	1,51E+00	1,49E-01	1,66E+00
GWP-total	kg CO2 eq	2,64E+03	1,38E+02	2,78E+03
AP	mol H+ eq	1,09E+01	1,57E+00	1,25E+01
EP-freshwater	kg P eq	1,16E+00	6,58E-02	1,22E+00
EP-marine	kg N eq	2,39E+00	3,66E-01	2,76E+00
EP-terrestrial	mol N eq	2,54E+01	3,90E+00	2,93E+01
POCP	kg NMVOC eq	1,21E+01	1,16E+00	1,33E+01
ODP	kg CFC-11 eq	4,55E-05	2,43E-06	4,80E-05
ADPe ¹	kg Sb eq	1,94E-02	2,49E-04	1,97E-02
ADPf ¹	MJ	2,66E+04	2,07E+03	2,86E+04
WDP ¹	m3 eq	1,59E+02	4,15E+01	2,01E+02

(1) The results of WDP, ADPe and ADPf shall be used with care as the uncertainties on these results are high or as there is limited experienced with the indicator.





Varnished OCTG Oil Country Tubular Goods

Resource Use

	Unit	Upstream	Core	Total
PERE	MJ	2,53E+03	1,75E+02	2,70E+03
PERM	MJ	0,00E+00	0,00E+00	0,00E+00
PERT	MJ	2,53E+03	1,75E+02	2,70E+03
PENRE	MJ	2,66E+04	2,04E+03	2,86E+04
PENRM	MJ	0,00E+00	0,00E+00	0,00E+00
PENRT	MJ	2,66E+04	2,04E+03	2,86E+04
SM	kg	0,00E+00	0,00E+00	0,00E+00
RSF	MJ	0,00E+00	0,00E+00	0,00E+00
NRSF	MJ	0,00E+00	0,00E+00	0,00E+00
FW	m3	2,00E+01	9,65E-01	2,09E+01

Resource use for 1 ton of OCTG production

Waste production

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	Unit	Upstream	Core	Total	1
HWD	kg	2,03E-01	7,66E-03	2,10E-01	4
NHWD	kg	1,06E+03	5,62E+01	1,12E+03	1
RWD	kg	1,92E-02	5,43E-03	2,47E-02	
Waste production for 1 ton of OCTG production				G,	

Output flows

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	Unit	Upstream	Core	Total
CRU	kg	0,00E+00	0,00E+00	0,00E+00
MFR	kg	0,00E+00	0,00E+00	0,00E+00
MER	kg	0,00E+00	0,00E+00	0,00E+00
EEe	MJ	0,00E+00	0,00E+00	0,00E+00
EEt	MJ	0,00E+00	0,00E+00	0,00E+00

Output flows for 1 ton of OCTG production







Additional Information

The EPD does not give information on release of dangerous substances to soil, water and indoor air because the horizontal standards on measurement of release of regulated dangerous substances from construction products using harmonized test methods according to the provisions of the respective technical committees for European product standards are not available.

The EPD owner has the sole ownership, liability, and responsibility of the EPD. EPDs within the same product category but registered in different EPD programs 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 characterization factors); have equivalent content declarations; and be valid at the time of comparison.

Differences from previous versions

Date of revision 2023-09-15: An update of the results was conducted due to the correction in modelling of steel production.





List of abbreviations

GWP-total	Global Warming Potential total
GWP-fossil	Global Warming Potential fossil
GWP-biogenic	Global Warming Potential biogenic
GWP-luluc	Global Warming Potential land use and land use change
ODP	Ozone Depletion Potential
AP	Acidification Potential
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
РОСР	Formation potential of tropospheric ozone photochemical oxidants
ADPe	Abiotic depletion potential for non-fossil resources
ADPf	Abiotic depletion potential for fossil resources
WDP	Water use
PERE	Use of renewable primary energy excluding 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 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 resources
SM	Use of secondary material
RSF	Use of renewable secondary fuels
NRSF	Use of non-renewable secondary fuels
FW	Use of net fresh water
HWD	Hazardous waste disposed
NHWD	Non-hazardous waste disposed
RWD	Radioactive waste disposed
CRU	Components for re-use
MFR	Materials for recycling
MER	Materials for energy recovery
EE	Exported Energy





References

- General Programme Instructions of the International EPD[®] System. Version 4.0, 2021-03-29
- PCR 2023:01

v.1.0 "Fabricated metal products, except construction products". EPD System. Date 2023-01-06. Valid until 2027-01-06

- ISO 14020:2000
 Environmental labels and declaration General principles
- ISO 14025:2006
 Environmental labels and declarations Type III environmental declarations Principles and procedures
- ISO 14040:2006 Environmental management - Life cycle assessment - Principles and framework
- ISO 14044:2006 Environmental management - Life cycle assessment - Requirements and guidelines
- Ecoinvent / Ecoinvent Centre, <u>www.Eco-invent.org</u>
- Residual Energy Mix 2021 from Renewable Energy Sources Operator & Guarantees of Origin (DAPEEP SA)
- Seventh global LCI study for steel product Worldsteel Association

