

# Environmental Product Declaration



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

## PC-strand – Prestressed steel for reinforcement of concrete

from

**Hjulsbro Steel AB**



Programme:	The International EPD® System, <a href="http://www.environdec.com">www.environdec.com</a>
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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](http://www.environdec.com)*



## General information

### Programme information

<b>Programme:</b>	The International EPD® System
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CEN standard EN 15804 serves as the Core Product Category Rules (PCR)
Product category rules (PCR): PCR 2019:14 Construction products, version 1.0
PCR review was conducted by: The Technical Committee of the International EPD® System. See <a href="http://www.environdec.com/TC">www.environdec.com/TC</a> for a list of members. Review chair: Claudia A. Peña, University of Concepción, Chile. The review panel may be contacted via the Secretariat <a href="http://www.environdec.com/contact">www.environdec.com/contact</a> .
Independent third-party verification of the declaration and data, according to ISO 14025:2006:  <input type="checkbox"/> EPD process certification <input checked="" type="checkbox"/> EPD verification
Third party verifier: DNV Business Assurance Italy S.r.l.
Accredited by: Accredia
Procedure for follow-up of data during EPD validity involves third party verifier:  <input checked="" type="checkbox"/> Yes <input type="checkbox"/> 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 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.

## Company information

### Owner of the EPD:

Hjulsbro Steel AB

Tallbergavägen 43, 589 41 Linköping, Sweden

Tel: +46 (0)13-32 82 00

Organization no 556259-6899

<https://hjulsbrosteel.com>

Contact: Joachim Törnfeldt

Description of the organisation: Hjulsbro Steel is an independent developer, producer and distributor of customized long steel products for high-quality applications. In a modern rolling mill and state-of-the-art wire processing center Hjulsbro Steel produces untreated and treated wire rod and drawn wire.

Product-related or management system-related certifications: Certified management systems are ISO 9001 and ISO 14001.

Name and location of production site(s): Hjulsbro Steel, Linköping, Sweden

## Product information

Product name: PC-strand

UN CPC code: 412

Product identification: Uncoated 3-wire and 7-wire steel PC-strand. 3-wire in dimensions from 6.5mm to 7.5mm, 7-wire in dimensions from 9.3mm to 15.7mm. Input of recycled material from the suppliers equals 25% recycled steel in the raw materials. Most of the suppliers have announced the share of post-consumer scrap.

Product description: The product studied are low alloyed steel wire rods that are drawn to smaller dimensions and twined into strands for use in prestressed concrete structures, also known as PC-strand Hjulsbro Steel's PC-strand product range consist of 3- and 7- wire strands made from high-quality wire rod in various steel grades depending on application. The detailed specifications of each PC –strand, such as dimensions and mechanical properties vary depending on the product ranges.

## Application

The PC-Strand product range is used primarily for prefabricated concrete elements, hollow core slabs, beams, TT-slabs or railway sleepers and in post tensioning constructions such as bridges or silos.

## Delivery status

The dimensions of the declared product may vary according to the particular requirements of the construction project. For transportation and storage, the PC- strands are winded into coils.

## Technical information

All PC-Strands are available with either plain or indented surface. The standard tensile strength is 1860 MPa, but other strengths are available. The 3-wire strand wires are of uniform thickness. In our 7-strands, the core wire diameter is at least 3 % greater than that of the outer helical wires.

The standard geometric and mechanical properties of each coil are tested in our own laboratory in accordance with the EN ISO 15630-3 standard. Hjulsbro Steel is also constantly monitored by the relevant standards authorities, ensuring that product standards are fully met.

The PC-Strands are delivered in precision-wound coils and have excellent pay-off properties. The standard coil weight for 3-wire strands is 1.4 or 2 tons, and 3, 4 and 5 tons for 7-wire strands coils. Bespoke coils can also be manufactured to customer specifications.

**LCA information**

Functional unit / declared unit: 1 kg PC- strand at the factory gate plus end-of life and resource recovery stages

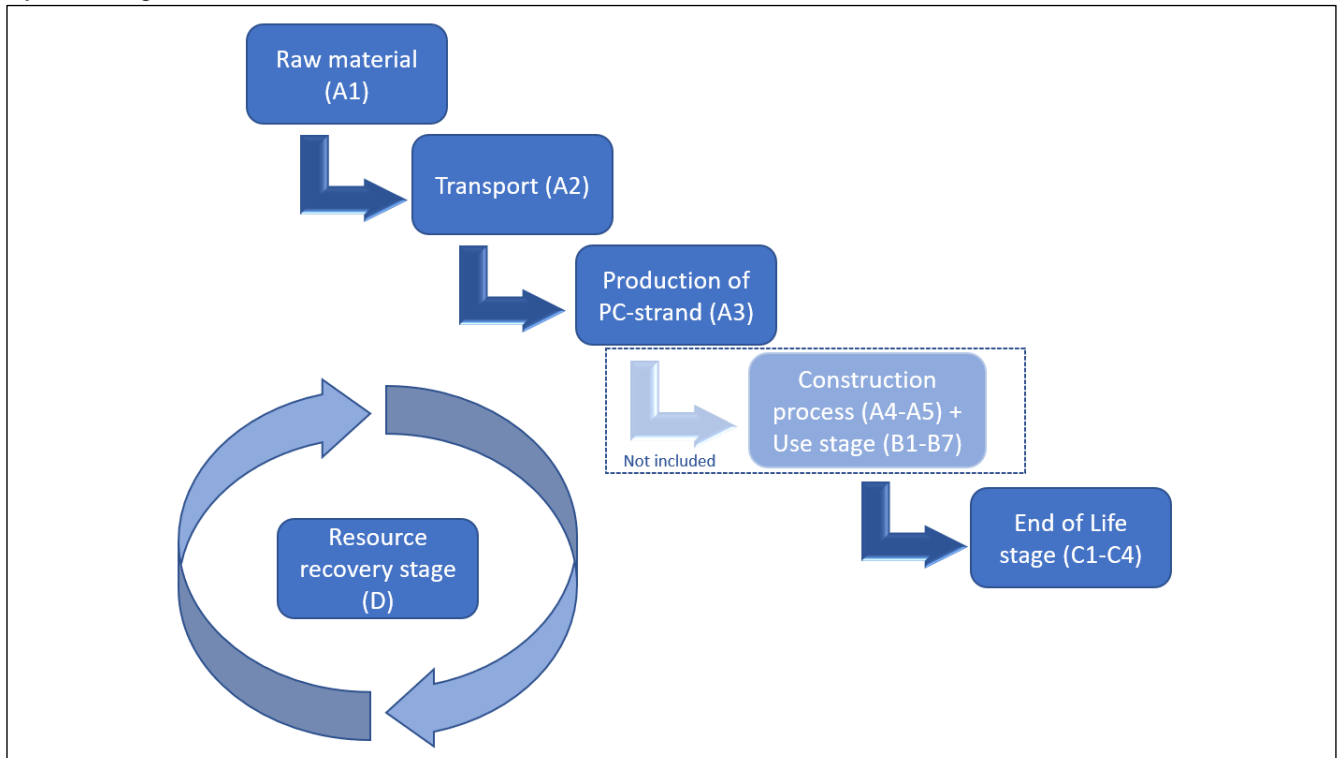
Time representativeness: 2022, generic data not older than 10 years.

Database(s) and LCA software used: SimaPro 9.5, Ecoinvent 3.9

Description of system boundaries:

Cradle to gate with modules C1–C4 and module D (A1–A3 + C + D)

System diagram:



More information on module D:

In module D an average flow of iron scrap and pig iron was calculated to represent the recovered flow going back to the system. A material loss is considered during the recycling phase.

**Specific energy information**

Electricity used in the core process at Hjulsbro Steel is 100% hydro power, 0,00726 kg CO2/kWh, data derives from Vattenfall EPD.

**Cut- off criteria**

Maintenance in the manufacturing process according to assumption that the impacts associated with these aspects are sufficiently small enough to fall below cut-off criteria of 5% of total inflows per module. Packaging related to delivery of raw materials and transport of raw material packaging also falls below the cut off criteria. Emissions released from the manufacturing (or technosphere) to air, soil and water is considered to be very small and therefore assessed to not be affecting the results in a significant way. These data are consequently excluded in the LCA.

**Data quality**

Data for use in module A3 is collected directly from the manufacturing process and consist of energy consumption and recorded amount of material for the PC- strand. The data used in module A1 is provided by suppliers of the wire rod and related components. The amount of post-consumer steel was based on the information actually available from the suppliers. The geographic region of the production site (A3) included in the calculation is Sweden. Data for A1- A2, C1-C4 and D represents the rest of the world. A2 are representing both internal and external transport. Generic data used in the EDP are not older than 10 years and site-specific data are not older than 3 years. Explanatory material may be obtained via contacting Hjulstro Steel AB.

**Methodology**

This declaration is a cradle to gate with modules developed within the International EPD System and based on the application of a Life Cycle Assessment (LCA) methodology. The LCA study was performed using SimaPro 9 software.

**Allocation**

Allocation between products or co- products have not been relevant due to that there are no co – products in the production of the PC-strand.

**Average product**

The two different PC-strand types (3- and 7-wire) is presented as an average product, since the environmental impact differences between them are very small (6,1 % for GWP-GHG CO<sub>2</sub>-equivalents/kg).

Modules declared, geographical scope, share of specific data and data variation:

	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	
Module	A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
Modules declared	X	X	X	ND	ND	ND	ND	ND	ND	ND	ND	ND	X	X	X	X	X
Geography	SE, DE, ES, US, NO, GB, FE	SE, DE, ES, US, NO, GB, FE	SE	-	-	-	-	-	-	-	-	-	SE	SE	SE	SE	SE
Specific data	38%		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Variation - products	<10%		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Variation - sites	Not relevant		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

## Content information

Product components	Weight, kg	Post-consumer material, weight-%	Biogenic material, weight-% and kg C/kg
Steel	1	40%	0
TOTAL	1	40%	0
Packaging materials	Weight, kg	Weight-% (versus the product)	Weight biogenic carbon, kg C/kg
Wood	0,00286	0,286	0,00838
Plastic (PET)	0,000104	0,01	0
Steel sheet metal band	0,00101	0,101	0
TOTAL	0,003974	0,397	0,00838

Note: 1 kg biogenic carbon is equivalent to 44/12 kg CO<sub>2</sub>.

The product contains no substances included in the REACH Candidate list (Substance of Very High Concern).

## End of life scenario information

Processes	Unit	Value
Collection process	Kg collected separately	1 kg
	Kg collected with mixed construction waste	-
Recovery system	Kg for re-use	0 kg
	Kg for recycling	0,92 kg
	Kg for energy recovery	0 kg
Disposal	Kg product or material for final deposition	0,08 kg
Assumptions for scenario development	-	Assumption of 0,0174 kWh diesel consumption per kg demolished. Assumption of 50 km distance to closest recycling facility and EURO 6 transport by truck.

## Environmental Information

Note that the impact categories below are only representing the impact potentials, which means that they are approximations of environmental impacts that could occur.

### Potential environmental impact – mandatory indicators according to EN 15804

Parameter	Unit	Results per declared unit								
		Production stage				End of life stage				Resource recovery stage
		A1	A2	A3	A1-A3	C1	C2	C3	C4	
GWP-total	Kg CO <sub>2</sub> - Eq	1,73E+00	7,79E-02	7,51E-03	1,81E+00	6,37E-03	9,51E-03	2,12E-02	8,56E-04	-1,05E+00
GWP-fossil	Kg CO <sub>2</sub> - Eq	1,71E+00	7,73E-02	5,87E-03	1,80E+00	6,37E-03	9,48E-03	2,12E-02	8,44E-04	-1,04E+00
GWP-biogenic	Kg CO <sub>2</sub> - Eq	1,58E-02	5,86E-04	5,23E-05	1,64E-02	2,57E-06	2,45E-05	1,62E-06	1,20E-05	-7,39E-03
GWP-luluc	Kg CO <sub>2</sub> - Eq	9,52E-04	5,71E-05	1,58E-03	2,59E-03	7,03E-07	4,60E-06	2,51E-05	1,82E-07	-6,67E-04
ODP	Kg CFC11 - Eq	2,31E-08	1,54E-09	2,16E-10	2,48E-08	9,88E-11	2,01E-10	3,25E-10	2,35E-11	-1,74E-08
AP	Mol H <sup>+</sup> Eq	6,16E-03	3,79E-04	3,49E-05	6,57E-03	5,76E-05	2,02E-05	2,50E-04	5,17E-06	-4,51E-03
EP-freshwater	Kg (PO <sub>4</sub> ) - Eq	4,95E-04	1,10E-05	3,63E-06	5,10E-04	1,91E-07	6,57E-07	1,37E-05	1,81E-07	-4,85E-04
EP-freshwater	Kg P Eq	1,63E-04	3,63E-06	1,20E-06	1,68E-04	6,30E-08	2,17E-07	4,52E-06	5,97E-08	-1,60E-04
EP-marine	Kg N Eq	1,36E-03	1,14E-04	1,75E-05	1,49E-03	2,67E-05	5,09E-06	5,56E-05	2,20E-06	-1,03E-03
EP-terrestrial	Mol N Eq	1,46E-02	1,21E-03	1,22E-04	1,59E-02	2,90E-04	5,18E-05	6,24E-04	2,36E-05	-1,05E-02
POCP	Kg NMVOC - Eq	6,37E-03	4,35E-04	3,07E-05	6,83E-03	8,60E-05	3,13E-05	1,85E-04	8,90E-06	-4,75E-03
ADP-minerals & metals*	Kg Sb- Eq	9,55E-06	2,38E-07	1,30E-05	2,28E-05	2,17E-09	3,02E-08	1,46E-06	1,52E-09	-7,17E-06
ADP-fossil	MJ	1,91E+01	1,09E+00	5,42E-02	2,03E+01	8,14E-02	1,31E-01	2,79E-01	1,85E-02	-1,05E+01
WDP	M3 depriv.	2,03E-01	5,63E-03	4,08E-03	2,13E-01	1,66E-04	5,29E-04	3,69E-03	8,07E-05	5,75E-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.

### Potential environmental impact – additional mandatory and voluntary indicators

Indicator	Unit	Results per declared unit								
		A1	A2	A3	A1-A3	C1	C2	C3	C4	D
		GWP-GHG*	kg CO <sub>2</sub> eq.	1,67E+00	7,56E-02	7,85E-03	1,75E+00	6,23E-03	9,26E-03	2,08E-02

\*The indicator includes all greenhouse gases included in GWP-total but excludes biogenic carbon dioxide uptake and emissions and biogenic carbon stored in the product. This indicator is thus equal to the GWP indicator originally defined in EN 15804:2012+A1:2013.



## Use of resources

Results per declared unit										
Parameter	Unit (kg)	A1	A2	A3	A1-A3	C1	C2	C3	C4	D
PERE	MJ	1,13E+00	4,00E-02	1,00E-01	1,28E+00	0,00E+00	0,00E+00	5,00E-02	0,00E+00	-9,60E-01
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	0,00E+00
PERT	MJ	1,13E+00	4,00E-02	1,00E-01	1,28E+00	0,00E+00	0,00E+00	5,00E-02	0,00E+00	-9,60E-01
PENRE	MJ	1,24E+01	1,16E+00	4,00E-02	1,36E+01	9,00E-02	1,40E-01	3,00E-01	2,00E-02	-1,12E+01
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	0,00E+00
PENRT	MJ	1,24E+01	1,16E+00	4,00E-02	1,36E+01	9,00E-02	1,40E-01	3,00E-01	2,00E-02	-1,12E+01
SM	KG	4,03E-01	0,00E+00	0,00E+00	4,03E-01	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	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	0,00E+00	0,00E+00
Net use of freshwater	m <sup>3</sup>	5,39E-03	2,30E-04	5,44E-05	5,68E-03	7,05E-06	2,20E-05	1,15E-04	2,09E-05	-1,17E-02
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 production and output flows

Results per declared unit									
Parameter	Unit	A1	A2	A3	C1	C2	C3	C4	D
HWD	Kg	0,00E+00	0,00E+00	3,67E-02	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
NHWD	Kg	0,00E+00	0,00E+00	2,28E-02	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
RWD	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
CRU	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
MFR	Kg	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	9,20E-01	0,00E+00	0,00E+00
MER	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
EE	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
Acronyms	HWD= Hazardous waste disposed; NHWD = Non hazardous waste disposed; RWD = Radioactive Waste disposed; CRU = Components for re-use; MRF = Materials for recycling; MER = Materials for energy recovery; EE= Exported energy,								

## Other environmental indicators

Results per declared unit										
Impact category	Unit	Production stage					End of life - stage			Resource recovery stage
		A1	A2	A3	A1-A3	C1	C2	C3	C4	D
Particulate Matter emissions*	disease inc.	7,63E-08	4,51E-09	1,93E-03	1,93E-03	1,59E-09	5,46E-10	3,22E-09	1,26E-10	-8,14E-08
Ionizing radiation, human health**	kBq U-235 eq	5,36E-02	4,82E-03	2,47E-04	5,87E-02	3,86E-05	1,78E-04	2,51E-03	4,27E-05	-3,24E-02
Eco-toxicity (freshwater)*	CTUe	2,80E+00	5,19E-01	7,40E-02	3,40E+00	4,14E-02	6,95E-02	1,74E-01	7,83E-03	-1,22E+01
Human toxicity, cancer effects*	CTUe	6,64E-09	4,42E-11	2,23E-11	6,71E-09	1,90E-12	4,21E-12	3,45E-11	4,08E-13	-8,05E-09
Human toxicity, non-cancer effects*	CTUe	2,59E-08	1,00E-09	1,70E-10	2,71E-08	4,19E-11	1,19E-10	1,71E-09	7,52E-12	-4,60E-08
Land use related impact/Soil quality*	Pt	3,54E+00	6,43E-01	2,39E-01	4,42E+00	5,44E-03	7,92E-02	5,40E-01	4,56E-02	-3,46E+00
Acronyms	Particulate Matter emissions= Potential incidence of disease due to PM emissions (PM) Ionizing radiation, human health= Potential Human exposure efficiency relative to U235 (IRP) Eco-toxicity (freshwater)= Potential Comparative Toxic Unit for ecosystems (ETP-fw) Human toxicity, cancer effects= Potential Comparative Toxic Unit for humans (HTP-c) Human toxicity, non-cancer effects= Potential Comparative Toxic Unit for humans (HTP-nc) Land use related impact/Soil quality= Potential soil quality index (SQI)									

\* Disclaimer: The result of this environmental impact indicator shall be used with care as the uncertainties on 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.

## Differences versus previous versions

Version 3 was updated on 2024-02-01 due to a difference of >10% for some of the environmental indicators when the LCA was updated with new data for 2022.

## References

Börling, T. (Envima AB) (2023). *Life Cycle Assessment for PC-strand, Hjulsbro Steel AB*

Erlandsson et al. (2015) Klimatpåverkan för byggnader med olika energiprestanda. Nr U 5176, Energimyndigheten och Boverket.

EN 15804:2012 + A2:2019 Sustainability of construction works – Environmental declaration- core rules for the product category construction products.

EPD Electricity from Vattenfall's Nordic Hydropower, Vattenfall AB, version 2.0: 2021-05-04

EPD Fjärrvärme för Linköpings fjärrvärmenät, Tekniska verken i Linköping AB, published 2023-03-17



General Programme Instructions of the International EPD® System. Version 4.0.

ISO 14025:2006 Environmental labels and declarations – Type III environmental declarations- Principles and procedures.

PCR 2019:14 Construction products, version 1.0

Stenmarck et al. (2018) Ökad plaståtervinning – potential för utvalda produktgrupper. Rapport 6844, Naturvårdsverket

Sveriges geologiska undersökning (2014) Uppdrag att utföra en kartläggning och analys av utvinnings- och återvinningspotential för svenska metall- och mineraltillgångar

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	<p><b>Commissioner of the Life Cycle Assessment</b>  Envima AB  Gjuterigatan 1D, Linköping, Sweden  Tel: + 46 (0)13376760  <a href="http://www.envima.se">www.envima.se</a></p>

