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Danfoss

Environmental **Product Declaration**

DEVI & EC Aqua heating cables

EPD issued	20.10.2023
EPD expires	20.10.2028
EPD author	Danfoss Climate Solutions
EPD type	Cradle-to-gate with options (A4, A5, C1-C4 & D)
Declared unit	1 m of cable with packaging
Products included	DEVI & EC Aqua heating cables (sales codes presented in Annex 1)
Manufacturing Location	Grodzisk, Poland
Use Location	Norway
Application	Multiple indoor floor constructions and pipe tracing applications
Mass	46,73 g without packaging (net weight) 69,73 g with packaging (gross weight)
Dimensions (H×W×D)	1 m
Verification	[ ] External [X] Internal [ ] None
Produced to	Danfoss Product Category Rules (2022-09)
Internal independent verifier	Danfoss Power Electronics & Drives A/S

DISCLAIMER
This EPD was prepared to the best of knowledge of Danfoss A/S. The life cycle assessment calculations were performed in accordance with ISO 14040 & 14044 and EN15804+A2.
All results were internally reviewed by independent experts. While this declaration has followed the guidance of ISO 14025, it has not been externally verified or registered by an EPD programme and therefore does not fully comply with the ISO 14025 standard.
This EPD has been published by Danfoss A/S on Danfoss Product Store and Danfoss Website. For questions, feedback or requests please contact your Danfoss sales representative.

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Introduction

This Environmental Product Declaration (EPD) follows the Danfoss Product Category Rules (PCR) (2022-09-20). These rules provide a consistent framework for calculating and reporting the environmental performance of Danfoss' products and is aligned with relevant international standards, particularly ISO 14025:2006 and EN 15804+A2:2019.

This document has been produced by Danfoss A/S following an internal verification process, but it is not a third-party verified document.

What is an EPD?

An EPD is a document used to communicate transparently, the quantified environmental impacts of a product over its lifecycle stages. This quantification is done by performing a Life Cycle Assessment (LCA) in line with a consistent set of rules known as a PCR (Product Category Rules).

An EPD provides:

- A product's carbon footprint together with other relevant environmental indicators, including air pollution, water use, energy consumption and waste, over its own life cycle (Modules A-C), as well as the expected benefits of reuse and recycling in reducing the impact of future products (Module D). See Table 1 for module descriptions.
- Environmental data allowing customers to calculate LCAs and produce EPDs for their own products.

Type of EPD

This EPD is of the type 'cradle-to-gate with options' and includes all relevant modules: production (A1-A3), shipping (A4), deconstruction (C1), waste collection and transport (C2), treatment (C3) and disposal (C4). It also includes potential net benefits to future products from recycling or reusing post-consumer waste (D). The codes in brackets are the module labels from EN 15804+A2. Module for installation and models concerning use, maintenance, repair, replacement, refurbishment, energy, and operational water use (B7) are excluded, following the cut-off rules from EN 15804.

Table 1: Modules of the product's life cycle included in the EPD

Product stage			Installation		Use stage							End-of-life stage				Benefits
Raw materials	Transport	Manufacture	Transport	Installation	Use	Maintenance	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	De-install.	Transport	Waste processing	Disposal	Benefits and loads outside system boundaries
A1	**A2**	**A3**	**A4**	**A5**	B1	B2	B3	B4	B5	B6	B7	**C1**	**C2**	**C3**	**C4**	**D**
X	**X**	**X**	**X**	X	MNR	MNR	MNR	MNR	MNR	MNR	MNR	**X**	**X**	**X**	**X**	**X**

(X = declared module; MNR = module not relevant)

Product Description

The DEVIaqua™ 9T is a light blue, high-quality, round, series resistive, full screened, twin conductor heating cable with a tough outer sheath and with a special ¾" and 1" pipe fitting. It is approved for use in contact with drinking water up to 23 °C.

Heating cable must be used together with an appropriate thermostat to secure against overheating and reduce energy consumption.

The DEVIaqua™ 9T is a heating cable developed for being installed inside drinking water pipes with the purpose to prevent frozen pipes (not for keeping water hot in pipes).

The heating cable is supplied in readymade lengths with a 3/4" and 1" fitting to establish a watertight entrance for the heating cable into the drinking water pipe. It is equipped with a UV stable cold lead with solid conductors ensuring fast installation with a clearly visible connection.

See more information about DEVIAqua™ on Danfoss product store.

Figure 1: DEVIAqua™ heating cables.

Intended market.

The intended market of this study is Norway, and the baseline scenario involves the distribution, installation, and end-of-life in Norway.

Table 2: Product composition

Object description	Net weight	Unit	%
Resin PEX LDPE	13,32	g	29%
Masterbatch XLPE	0,72	g	2%
Wire Cu 0.4mm	12,32	g	26%
Alu foil	1,70	g	4%
Resin PE	18,67	g	40%
Total product	**46,73**	**g**	100%
Cardboard	22,54	g	98%
PS	0,46	g	2%
Total packaging	**23,00**	**g**	**100%**

Product Description

Product	46,73	g	67%
Packaging	23,00	g	33%
Total product & packaging	**69,73**	**g**	**100%**

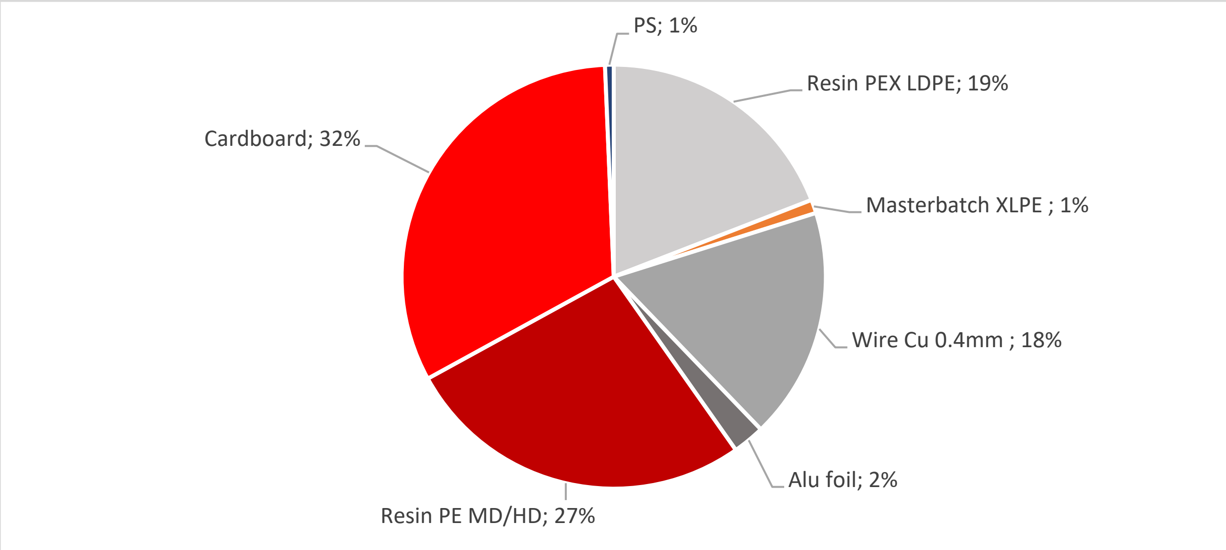

Figure 3: Material Composition Overview

The declared unit is 1 m of cable with packaging, with the mass of 69,73 g

A product comparison on material level was performed for all codes, the code with the highest mass of heating wire was selected. The EPD values were calculated for this composition (cable type a in table 3). This composition represents the highest environmental values for all the product codes in DEVI & EC Aqua heating cables, therefore it represents all the products in the Aqua heating cables product group. All sales codes covered by this EPD are shown in table 13.

This EPD covers multiple sales codes for Aqua heating cables. The outer insulation of the heating cables is made from the same material for all sales codes. Within these sales codes, there are 4 material combinations for the heating part (metal wire) of the heating cables. Table 3 shows the material compositions for all 4 combinations.

Table 3: Product composition for Aqua heating cables codes

Cable type	Aqua cable combinations
a	Copper
b	Stainless steel
c	Copper
	Stainless steel
	Kevlar
d	Copper
	Stainless steel
	NICR

Overview of LCA study

Data quality

Data quality of the selected datasets is generally assessed as good and very good in terms of geographical, time and technology representativeness and applicability. Background data is from LCA software LCA for experts (Sphera) database version 2023.1.

Allocation and cut-off criteria

The allocation is made in accordance with the provisions of EN 15804+A2. All major raw materials and all the essential energy are included. All hazardous materials and substances are considered in the inventory. Data sets within the system boundary are complete and fulfil the criteria for the exclusion of inputs and output criteria. No known material or energy flows were ignored, including those which fell below the limit of 1%. Accordingly, the total sum of input flows ignored is certainly less than 5% of the energy and mass applied.

Due to its low mass Kevlar & NICR are excluded from the study. LDPE was used to represent XLPE & the PE (MD/HD) resin.

Accordingly, the total sum of input flows ignored is certainly less than 5% of the energy and mass applied.

System boundaries

The results in this EPD are split into life cycle modules following EN 15804 (Figure 1): production (A1-A3), distribution (A4), (A5) installation and the end of the product's life (C1-C4). Module D represents environmental benefits and loads that occur beyond the system boundary (i.e., in future products).

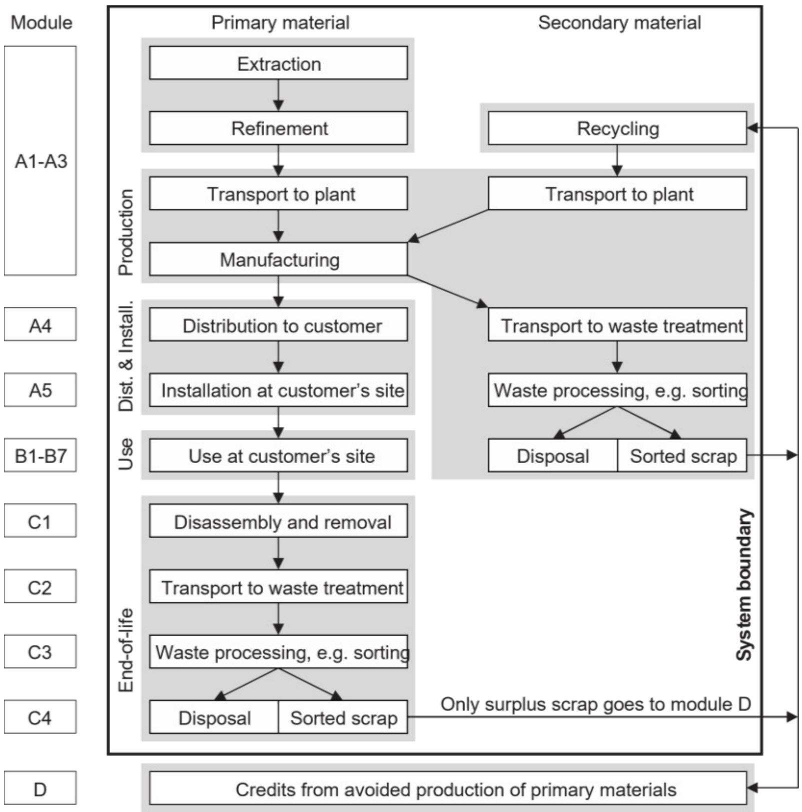

Figure 4: Modular structure used in this EPD (following EN 15804+A2)

Overview of LCA study

Product and packaging manufacture (A1-A3)

Final manufacturing occurs in the Grodzisk plant, Poland, data collected for year 2022. The raw materials are mainly sourced from Europe. Electricity is used to press the heating metal core together with the outside shell. Electricity consumption was calculated as the sum of total yearly electricity consumption divided by total m of cables made. The product is then cut to desired length and shipped to the costumer. The facility is certified according to ISO 9001 & ISO 14001. Where waste generated on-site is recyclable, it is separated and recycled. For further information, see here. The manufacturing plant also uses GOs, for its electricity consumption (Wind powered electricity).

Table 4: Biogenic carbon content in product

	Total (excluding recycling)
Biogenic carbon content in packaging [kg]	5,90E-03

Note: 1 kg biogenic carbon is equivalent to 44/12 kg of CO_2.

Shipping and installation (A4-A5)

The intended market for Aqua heating cables is Norway. The assembly factory is in Poland, so a distance of 1162 km by truck and 163 km by container ship (representing a ferry) was used to represent the distance between the factory and the final customer.

Module A5 includes disposal of packaging materials only, the benefits from e.g., energy recovered after plastic incineration are allocated to module D. The product is assumed to be installed by hand and there is no loss of product during installation. Energy use in handheld tools during installation is not included as it falls under the cut-off criteria.

End-of-life (C1-C4)

The following end-of-life procedure has been applied:

- Manual dismantling is used to separate recyclable bulk materials, e.g. bulk metals and plastics.
- Shredding is used for the remaining parts, such as printed circuit board assemblies.
- Ferrous metals, non-ferrous metals and bulk plastics are recovered through recycling.
- The remaining materials go to either energy recovery or landfill.

In line with EN 15804+A2, only the 'net scrap' (i.e., the leftover recyclable materials remaining after inputs of recycled content required in the manufacturing phase are first satisfied) is used to calculate the benefits and loads beyond the system boundary (Module D).

For this EPD an average scenario with 50% of the product sent to recycling & 50% of the product sent to landfill (C3, C4, D) was used.

This scenario is designed to represent an average end-of-life scenario.

For the EPD this average scenario was chosen as it is assumed that it represents the majority of cases on average.

1. Recycling scenario with 100% of the product sent to recycling at the end-of-life, excluding fractions that cannot be recycled or incinerated (e.g., glass reinforcing in glass-filled plastics) and are sent to landfill.

This scenario illustrates best case performance. It assumes a 100% collection rate and best available recycling technologies. Under this scenario electrical cables, and all metals, flat glass and unreinforced plastics found within the body and chassis of the product are recycled. Printed circuit board assemblies are incinerated, and the copper and precious metals (gold, silver, palladium, and platinum) are recycled.

2. Landfill scenario with 100% of the product sent to landfill.

This scenario assumes that the whole product, including its packaging, is landfilled. It is designed to represent a poor end of-life-route where valuable resources are lost.

Benefits and loads beyond the system boundary (D)

Module D considers the net benefit of recycling (including energy recovery) of materials in the product and packaging, taking account of losses in the recycling process and the recycled material used in the production of the product. Module D covers the two end-of-life scenarios, as described above.

Environmental performance

This section presents the environmental performance of 1 m of Aqua heating cable with packaging. Figure 5 presents the environmental impact of 1m of Aqua heating cable across a number of environmental impact categories (following EN 15804+A2:2019) per life cycle stage, over its full life cycle, including Global Warming Potential.

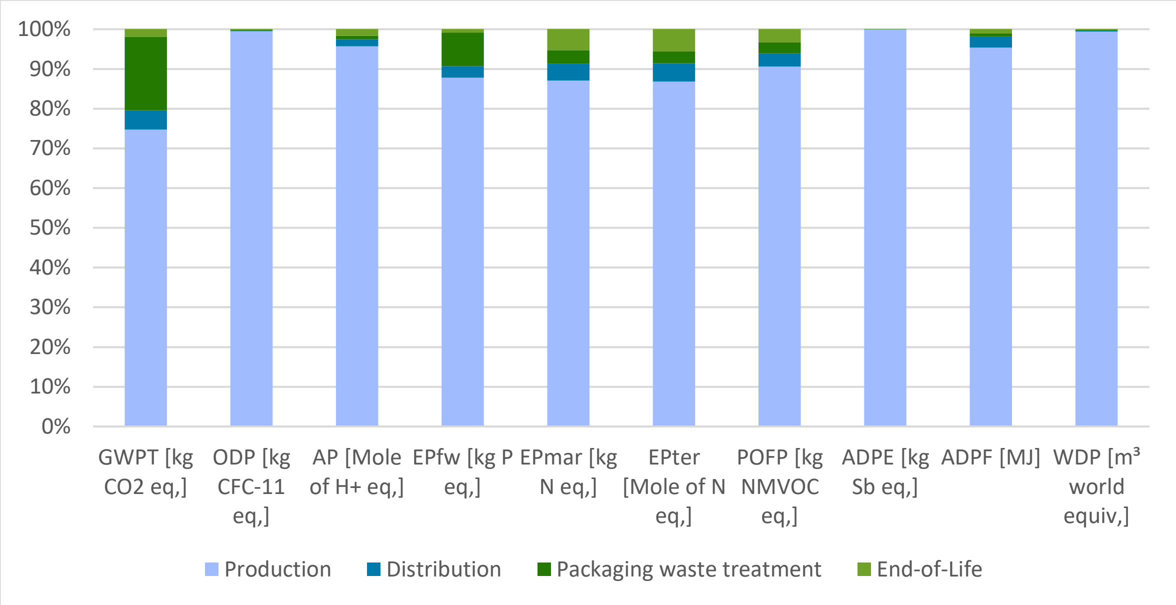

Figure 5: Breakdown of environmental impacts by life cycle stages (see Table 6 for descriptions of environmental impact indicators).

Table 5: Environmental impact indicators

	Production	Distribution	Packaging waste treatment	End-of-Life				(not included in Figure 5)
Life cycle stages based on EN 15804+A2	**A1-A3**	**A4**	**A5**	**C1**	**C2**	**C3**	**C4**	**D**
Description / **Environmental Impact Indicators**	Manufacture of the product from 'cradle-to-gate'	Transport of the product to the customer	Installation of the product and disposal of used packaging	Deinstallation of the product from the site	Transport of the product to waste treatment	Processing waste for recycling	Disposal of waste that cannot be recycled (through landfill and incineration)	Potential benefits and loads beyond the system boundary due to reuse, recycling, and energy recovery
GWPT [kg CO2 eq.]	1,52E-01	9,67E-03	3,78E-02	0,00E00	4,77E-04	2,68E-03	6,16E-04	-9,03E-02
GWPF [kg CO2 eq.]	1,87E-01	9,58E-03	2,22E-03	0,00E00	4,77E-04	2,66E-03	6,15E-04	-9,00E-02
GWPB [kg CO2 eq.]	-3,55E-02	0,00E+00	3,55E-02	0,00E00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
GWPLULUC [kg CO2 eq.]	3,54E-04	8,67E-05	2,24E-06	0,00E00	1,15E-08	2,43E-05	1,10E-06	-2,69E-04
ODP [kg CFC-11 eq.]	7,85E-13	1,23E-15	1,47E-15	0,00E00	5,57E-20	3,42E-16	8,95E-16	-4,47E-13
AP [Mole of H+ eq.]	1,23E-03	2,21E-05	1,18E-05	0,00E00	6,54E-07	1,65E-05	4,07E-06	-1,43E-03
EPfw [kg P eq.]	1,04E-06	3,43E-08	9,98E-08	0,00E00	1,03E-10	9,60E-09	7,65E-10	-1,40E-07
EPmar [kg N eq.]	1,61E-04	7,85E-06	6,35E-06	0,00E00	2,60E-07	8,05E-06	1,43E-06	-8,10E-05
EPter [Mole of N eq.]	1,68E-03	8,92E-05	5,80E-05	0,00E00	2,86E-06	8,95E-05	1,57E-05	-8,45E-04
POFP [kg NMVOC eq.]	5,22E-04	1,87E-05	1,59E-05	0,00E00	6,20E-07	1,53E-05	3,43E-06	-2,85E-04
ADPE [kg Sb eq.]	3,88E-05	6,18E-10	1,13E-10	0,00E00	1,70E-11	1,73E-10	2,56E-11	-6,15E-05
ADPF [MJ]	4,33E+00	1,30E-01	3,00E-02	0,00E00	6,88E-03	3,58E-02	8,45E-03	-1,02E+00
WDP [m^3 world equiv.]	5,34E-02	1,13E-04	1,35E-04	0,00E00	8,05E-07	3,17E-05	3,90E-05	-4,88E-02

Table 6: Environmental impact indicator descriptions

Acronym	Unit	Indicator
GWPT	kg CO_2 eq.	Carbon footprint (Global Warming Potential) – total
GWPF	kg CO_2 eq.	Carbon footprint (Global Warming Potential) – fossil
GWPB	kg CO_2 eq.	Carbon footprint (Global Warming Potential) – biogenic
GWPLULUC	kg CO_2 eq.	Carbon footprint (Global Warming Potential) – land use and land use change
ODP	kg CFC-11 eq.	Depletion potential of the stratospheric ozone layer
AP	Mole H+ eq.	Acidification potential
EPfw	kg P eq.	Eutrophication potential – aquatic freshwater
EPmar	kg N eq.	Eutrophication potential – aquatic marine
EPter	Mole of N eq.	Eutrophication potential – terrestrial
POFP	kg NMVOC eq.	Summer smog (photochemical ozone formation potential)
ADPE*	kg Sb eq.	Depletion of abiotic resources – minerals and metals
ADPF*	MJ	Depletion of abiotic resources – fossil fuels
WDP*	m^3 world eq.	Water deprivation potential (deprivation-weighted water consumption)

Results for module A1-A3 are specific to the product. All results from module A4 onwards should be considered as scenarios that represent one possible outcome. The true environmental performance of the product will depend on actual use.

The results in this section are relative expressions only and do not predict actual impacts, the exceeding of thresholds, safety margins, or risks. EPDs from others may not be comparable.

Carbon footprint

The total carbon footprint (GWPT), cradle-to-grave, of the product is 2,03E-01 kg CO2-eq (A1-C4). The carbon footprint (GWPT) of production of this product, cradle-to-gate, is 1,52E-01 kg CO2-eq (A1-A3).

Table 7: Resource use

	A1-A3	A4	A5	C1	C2	C3	C4	D
PERE [MJ]	1,58E+00	9,29E-03	1,83E-03	0,00E00	2,27E-05	2,60E-03	7,75E-04	-3,29E-01
PERM [MJ]	0,00E+00	0,00E+00	0,00E+00	0,00E00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
PERT [MJ]	1,58E+00	9,29E-03	1,83E-03	0,00E00	2,27E-05	2,60E-03	7,75E-04	-3,29E-01
PENRE [MJ]	4,34E+00	1,30E-01	3,14E-02	0,00E00	6,89E-03	3,59E-02	8,50E-03	-1,12E+00
PENRM [MJ]	0,00E+00	0,00E+00	0,00E+00	0,00E00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
PENRT [MJ]	4,34E+00	1,30E-01	3,14E-02	0,00E00	6,89E-03	3,59E-02	8,50E-03	-1,12E+00
SM [kg]	1,46E-02	0,00E+00	0,00E+00	0,00E00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
RSF [MJ]	0,00E+00	0,00E+00	0,00E+00	0,00E00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
NRSF [MJ]	0,00E+00	0,00E+00	0,00E+00	0,00E00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
FW [m3]	1,65E-03	1,02E-05	4,31E-06	0,00E00	3,64E-08	2,85E-06	1,20E-06	-1,01E-03

Table 8: Resource use indicator descriptions

Acronym	Unit	Indicator
PERE	MJ	Use of renewable primary energy excluding renewable primary energy resources used as raw materials
PERM	MJ	Use of renewable primary energy resources used as raw materials
PERT	MJ	Total use of renewable primary energy resources (primary energy and primary energy resources used as raw materials)
PENRE	MJ	Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials
PENRM	MJ	Use of non-renewable primary energy resources used as raw materials
PENRT	MJ	Total use of non-renewable primary energy resources (primary energy and primary energy resources used as raw materials)
SM	kg	Use of secondary material
RSF	MJ	Use of renewable secondary fuels
NRSF	MJ	Use of non-renewable secondary fuels
FW	m^3	Net use of fresh water

Table 9: Waste categories and output flows

	A1-A3	A4	A5	C1	C2	C3	C4	D
HWD [kg]	8,59E-09	4,03E-13	1,05E-12	0,00E00	4,74E-14	1,11E-13	1,28E-13	-1,21E-10
NHWD [kg]	2,66E-02	1,97E-05	8,55E-03	0,00E00	6,89E-07	5,45E-06	2,34E-02	-3,42E-02
RWD [kg]	1,10E-04	2,42E-07	1,88E-07	0,00E00	7,37E-09	6,70E-08	5,75E-08	-1,93E-05
CRU [kg]	0,00E00	0,00E00	0,00E00	0,00E00	0,00E00	0,00E+00	0,00E+00	0,00E+00
MFR [kg]	0,00E00	0,00E00	0,00E00	0,00E00	0,00E00	0,00E+00	2,34E-02	0,00E+00
MER [kg]	0,00E00	0,00E00	0,00E00	0,00E00	0,00E00	0,00E+00	0,00E+00	0,00E+00
EEE [MJ]	0,00E00	0,00E00	0,00E00	0,00E00	0,00E00	0,00E+00	0,00E+00	0,00E+00
EET [MJ]	0,00E00	0,00E00	0,00E00	0,00E00	0,00E00	0,00E+00	0,00E+00	0,00E+00

Table 10: Waste category and output flow descriptions

Acronym	Unit	Indicator
HWD	kg	Hazardous waste disposed
NHWD	kg	Non-hazardous waste disposed
RWD	kg	Radioactive waste disposed
CRU	kg	Components for reuse
MFR	kg	Materials for recycling
MER	kg	Materials for energy recovery
EEE	kg	Exported energy (electrical)
EET	kg	Exported energy (thermal)

Table 11: Additional indicators*

	A1-A3	A4	A5	C1	C2	C3	C4	D
PM [Disease incidences]	1,07E-08	2,19E-10	8,74E-11	0,00E00	9,08E-12	1,07E-10	4,05E-11	-1,21E-08
IRP [kBq U235 eq.]	1,85E-02	3,61E-05	2,48E-05	0,00E00	1,04E-06	1,00E-05	6,75E-06	-4,20E-03
ETPfw [CTUe]	2,38E+00	9,21E-02	2,61E-02	0,00E00	4,99E-03	2,54E-02	8,60E-02	-9,77E-01
HTPc [CTUh]	1,02E-10	1,88E-12	7,46E-13	0,00E00	9,28E-14	5,20E-13	4,44E-13	-6,36E-11
HTPnc [CTUh]	5,34E-09	1,05E-10	7,17E-11	0,00E00	4,05E-12	3,27E-11	4,59E-11	-5,35E-09
SQP [Pt]	2,53E+00	5,33E-02	4,46E-03	0,00E00	1,76E-05	1,50E-02	1,15E-03	-9,10E-01

Table 12: Optional indicator descriptions

Acronym	Unit	Indicator
PM	Disease incidence	Potential incidence of disease due to particulate matter emissions
IRP**	kBq U235 eq.	Potential human exposure efficiency relative to U235
ETPfw*	CTUe	Potential Comparative Toxic Unit for ecosystems (fresh water)
HTPc*	CTUh	Potential Comparative Toxic Unit for humans (cancer)
HTPnc*	CTUh	Potential Comparative Toxic Unit for humans (non-cancer)
SQP*	Dimensionless	Potential soil quality index

**Disclaimer for ADPE, ADPF, WDP, ETPfw, HTPc, HTPnc, SQP:* The results of these environmental impact indicators shall be used with care as the uncertainties on these results are high or as there is limited experienced with the indicator.

***Disclaimer for ionizing radiation:* 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.

Annex 1: The sales codes of all cables covered in this EPD

To calculate the actual GWPT of purchased product, just multiply the GWPT form this EPD with the length [m] of the purchased product sales code.

Example:

Sales code: 140F0009

Length: 35,00 m

GWPT: 0,203kgCO2eq/m

Greenhouse gases from the cable 35,00 m x 0,203 kgCO2eq/m = 7,105 kgCO2eq

Table 13: Aqua sales codes, covered by this EPD

Devi Aqua			
Sales code	Product description	Lengt [m]	Combination
140F0000	DEVIaqua 9T 3m 230V 25W	3	C
140F0001	DEVIaqua 9T 5m 230V 45W	5	D
140F0001	DEVIaqua 9T 5m 230V 45W	5	D
140F0002	DEVIaqua 9T 7m 230V 65W	7	C
140F0003	DEVIaqua 9T 10m 230V 90W	10	C
140F0004	DEVIaqua 9T 12m 230V 110W	12	C
140F0005	DEVIaqua 9T 15m 230V 135W	15	C
140F0006	DEVIaqua 9T 20m 230V 180W	20	B
140F0007	DEVIaqua 9T 25m 230V 225W	25	B
140F0008	DEVIaqua 9T 30m 230V 270W	30	B
140F0008	DEVIaqua 9T 30m 230V 270W	30	B
140F0009	DEVIaqua 9T 35m 230V 315W	35	B
140F0010	DEVIaqua 9T 40m 230V 360W	40	B
140F0011	DEVIaqua 9T 50m 230V 450W	50	A
140F0012	DEVIaqua 9T 60m 230V 540W	60	A
140F0013	DEVIaqua 9T 70m 230V 630W	70	A
140F0014	DEVIaqua 9T 80m 230V 720W	80	A
140F0015	DEVIaqua 9T 90m 230V 810W	90	A
140F0016	DEVIaqua 9T 100m 230V 900W	100	A
140F0017	DEVIaqua 9T 110m 230V 990W	110	A
140F0018	DEVIaqua 9T 120m 230V 1080W	120	A
140F0019	DEVIaqua 9T 130m 230V 1170W	130	A
140F0020	DEVIaqua 9T 140m 230V 1260W	140	A
140F0021	DEVIaqua 9T 150m 230V 1350W	150	A
140F0022	DEVIaqua 9T 157m 230V 1405W	157	A
140F0023	DEVIaqua 9T 167m 230V 1510W	167	A
140F0024	DEVIaqua 9T 187m 230V 1695W	187	A
140F0025	DEVIaqua 9T 210m 230V 1895W	210	A
140F0026	DEVIaqua 9T 219m 230V 1965W	219	A

140F0027	DEVIaqua 9T 240m 230V 2160W	240	A
140F0030	DEVIaqua 9T 272m 400V 2450W	271	A
140F0031	DEVIaqua 9T 290m 400V 2625W	290	A
140F0032	DEVIaqua 9T 326m 400V 2940W	326	A
140F0033	DEVIaqua 9T 366m 400V 3285W	366	A
140F0034	DEVIaqua 9T 380m 400V 3425W	380	A
140F0035	DEVIaqua 9T 417m 400V 3760W	417	A
89204013	DEVIaqua 18 3,5m 230V 64W DK Epoke	3,5	D

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References

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