Environmental Product Declaration

In accordance with ISO 14025:2006 and EN 15804:2012+A2:2019/AC:2021 for:

Enduce E1

from

Enduce AB

Programme:	The International EPD® System, www.environdec.com
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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

General information

Programme information

Programme:	The International EPD® System
Address:	EPD International AB Box 210 60 SE-100 31 Stockholm Sweden
Website:	www.environdec.com
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Accountabilities for PCR, LCA and independent, third-party verification
Product Category Rules (PCR)
CEN standard EN 15804 serves as the Core Product Category Rules (PCR)
Product Category Rules (PCR): *Construction products, 2019:14, Version 1.3.1*
PCR review was conducted by: *The Technical Committee of the International EPD® System. Claudia A. Peña. Contact via info@environdec.com*
Life Cycle Assessment (LCA)
LCA accountability: *Daniel Böckin and Annie Johansson, Miljögiraff AB*
Third-party verification
Independent third-party verification of the declaration and data, according to ISO 14025:2006, via: ☐ EPD verification by individual verifier Third-party verifier: *Viktor Hakkarainen, VästLCA, viktor@vastlca.se* Approved by: The International EPD® System
Procedure for follow-up of data during EPD validity involves third party verifier: ☐ Yes ☒ 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, or not compliant with EN 15804, 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. For further information about comparability, see EN 15804 and ISO 14025.

Company information

Owner of the EPD:
Enduce AB
TVISTEVÄGEN 47
907 29 Umeå

Contact: Henrik Hagman, henrik.hagman@enduce.se

Description of the organisation: Enduce is a Swedish, Umeå based company, dedicated to driving the transition to environmentally friendly and climate-smart showers with its world-leading technology. Hot tap water heating represents the single largest energy consumer after space heating for residential and hotel buildings. The majority of hot tap water is used for showering.

Enduce has developed the world's most energy efficient shower floor drain, having an application-specific energy recycle efficiency of 71-75% at a shower flow of 10 l/min[1] (Passive House Institute, n.d.; Research Institutes of Sweden AB, 2022). The technology reduces hot water consumption and energy usage to as little as a quarter compared to traditional showers without compromising comfort, hygiene, or design. In addition to leading efficiency, Enduce has also developed a user-friendly cleaning system that prevents the clogging issues that have previously hindered energy recovery from greywater.

Overall, Enduce successfully combines leading efficiency with easy cleaning and an affordable price and an affordable price, making the product economically accessible and profitable. Enduce contributes an essential piece to the transition towards a more sustainable society.

The energy-saving potential for Enduce's technology amounts to approximately 12 TWh/year for Nordic households[2]. The equivalent saving potential for OECD countries is around 615 TWh/year, resulting in substantial potential emission reductions of greenhouse gases and environmental impact. Therefore, with its cost-effective and leading shower energy recovery technology, Enduce can significantly contribute to the fight against environmental and climate change.

Name and location of production site(s): Umeå (address to be decided)

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[1] The Passive House Institute presents “nominal efficiencies” which can be up to 78%, but in the underlying certificates the actual measured performances are presented which are at most 30-63%.
[2] Based on a warm water use in EU of 1000 kWh/person/year (Eurostat, 2019) and a use case of 60% of the warm water being used for showers, an Enduce E1 energy efficiency of 73% and a population in the Nordics of 27,4 million people (including only households, no commercial facilities or hotels)

Product information

Product name: Enduce E1

Product description: Energy recycling shower drain with an energy recovery efficiency of up to 75 %, having the following design highlights:

- Industrial grade plate heat exchanger
- Integrated cleaning system for user friendly and efficient heat recovery over time
- Integrated tap water connection cabinet for secure tap water connections
- Robust design without moving parts
- Free from electricity or electronics
- Construction material; Stainless steel, PP-plastics, low-lead brass
- Fully repairable

UN-CPC code: 42911

Geographical scope:

Production takes place in Sweden, Lithuania, Denmark and Italy.
For installation, use and waste management, this EPD considers Sweden as a representative case, Enduce's main market is Europe.
The product is assembled at the installation site in Sweden. Some components are sent directly from the supplier to the installation site, while others go via Enduce's central warehouse in Umeå, Sweden. Waste management is modelled to represent Sweden.

LCA information

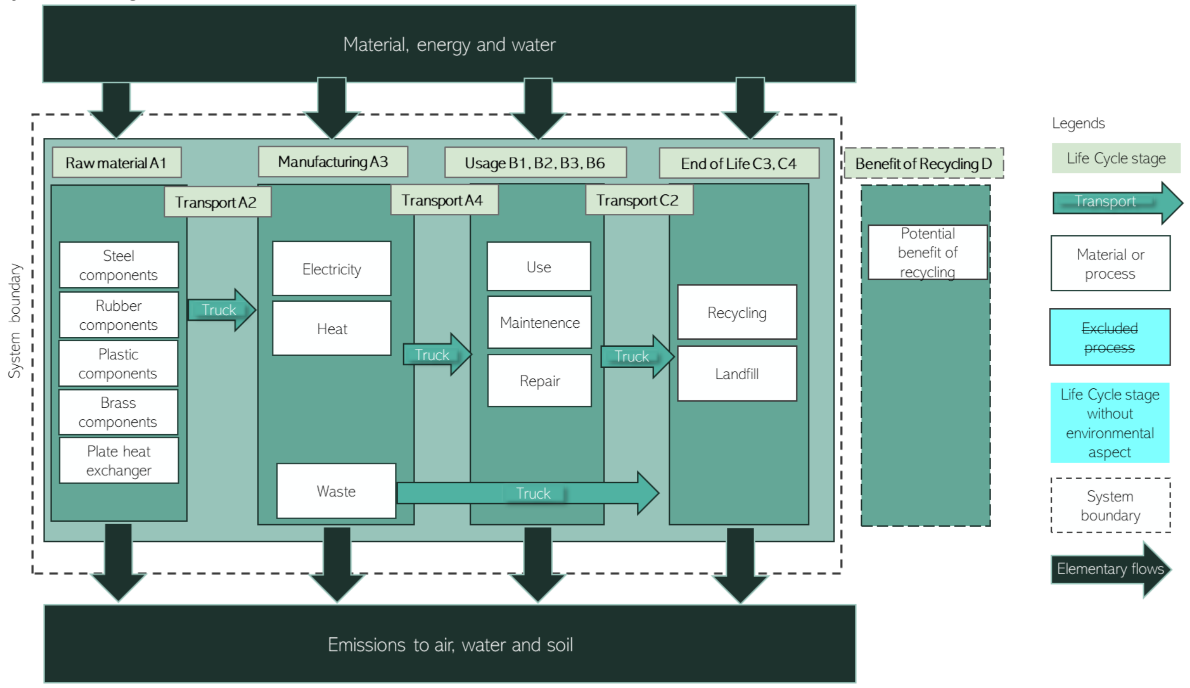
Functional unit / declared unit: The declared unit is one Enduce floor drain in use for 30 years

Time representativeness: Reference year for collected data is 2023 (2023-01-01 – 2023-08-18)

Database(s) and LCA software used: ecoinvent 3.9.1 with SimaPro 9.5

Description of system boundaries: b) Cradle to gate with options, modules C1–C4, module D and with optional modules (A4–A5, B1 and B4)

System diagram:



Modules declared, geographical scope, share of specific data (in GWP-GHG results) and data variation (in GWP-GHG results):

	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	Reuse-Recovery-Recycling-potential
Module	**A1**	**A2**	**A3**	**A4**	**A5**	**B1**	**B2**	**B3**	**B4**	**B5**	**B6**	**B7**	**C1**	**C2**	**C3**	**C4**	**D**
Modules declared	X	X	X	X	X	X	ND	ND	X	ND	ND	ND	X	X	X	X	X
Geography	EU/ SE	EU/ SE	EU/ SE	EU/ SE	SE	SE	-	-	SE	-	-	-	SE	SE	SE	SE	SE
Specific data used	1,2%*			-	-	-	-	-	-	-	-	-	-	-	-	-	-
Variation – products	0%			-	-	-	-	-	-	-	-	-	-	-	-	-	-
Variation – sites	0%			-	-	-	-	-	-	-	-	-	-	-	-	-	-

* Only transportation distances in A2 count as specific, despite the model being adapted to the known chemical composition of the stainless steel used

Summary of model:
Enduce E1 contains components of stainless steel, brass, rubber, plastic and a plate heat exchanger consisting of a mixture of stainless steel and copper. The steel components are modelled with specific chemical compositions.
An estimated 65,6% of the stainless steel is from post-consumer recycled steel. The amount was estimated based on one of the main stainless steel suppliers of Enduce's supplier in Lithuania, namely Outokumpu Abp. Their average rate of post-consumer recycled input over 2018-2022 is 65,6% (Outokumpu Abp, n.d.). In addition to this amount of post-consumer scrap, the statistics also show an amount of ca 19-23% pre-consumer scrap. However, it is not specified whether it is internal or external scrap, why it was conservatively assumed to be internal scrap (thus avoiding co-product allocation) with no environmental benefits.
No allocation is performed in the model.
Infrastructure is excluded from the model, as recommended by PCR 2019:14 v1.3.1.

Manufacturing is done by Enduce's suppliers. Some components are sent directly to the installation site, while the rest are manually assembled in the central warehouse in Umeå before being sent to the end customer. Since manual assembly is cut off, the A3 module contains only impacts from packaging.

Transport to customer (A4) is modelled differently for different components. The components passing Enduce's site in Umeå are repackaged and sent to the customer. The components that are sent directly to the customer from the supplier of the component are packaged there and sent to the customer.
The finished products are loaded on a truck and transported to a client. The the end-client is usually located somewhere between Stockholm and Göteborg, Sweden. Therefore, Mjölby is used as the representative location of the client and distances from Umeå as well as suppliers of components that go directly to the client are assessed to Mjölby.

Installation consists of manual labour using for example a screwdriver. This installation work is estimated to fall under the cut-off in the study. Disposal of the packaging that is delivered with the product to the final customer is included according to the waste scenario in module C.

Usage of Enduce E1 includes modules B1 and B4 and covers use over the product lifetime of 30 years at an average Swedish customer. When installed, the product provides its function of reducing heating needs for showering. The benefits of this are calculated in the D-module. The usage does not affect module B1, except for the indicator for exported thermal energy, where the total avoided energy use over 30 years of use is 43 470 kWh, assuming an average energy consumption in Swedish households of 1150 kWh per person and year (Energimyndigheten, 2009), an average of 60% of this being used for household showers (Energimyndigheten, 2009) and an average estimated household size among Enduce's customers of 3 people (this estimate is based on the fact that the customer's economic savings increasing with more residents in the household and that an average Swedish family size is 3,5 people, or 2,5 people in a divorced family (Statistikmyndigheten, n.d.)). The total amount was calculated as 62 100 kWh of burden free energy entering the system as warm wastewater, of which 70% (43 470 kWh) is captured by Enduce E1 and sent into another system (energy exported into the shower system) and the remaining 30% (18 630 kWh) is lost with the exiting wastewater. For other scenarios and their potential benefits, see section "Other scenarios for climate benefits from reduced water heating energy use".
Module B4 includes replacement of non-stainless-steel components after 15 years. To account for this, the manufacturing of the products, transport to Enduce in Umeå, assembly and repackaging as well as transports to the customer are included in the model as an additional life cycle

The **end of life** (module C) is modelled to occur in Sweden. No relevant environmental aspects have been identified in the dismantling phase (C1). Most components can be manually separated into different material streams. Additionally, there is an industrial process for separating the copper and steel in the plate heat exchanger but it was cut off since it was estimated to have a minor total contribution.
The dismounted product is transported to the waste facility for waste treatment (C2), assuming an average distance to the closest waste management facility of 50 km.
Modules C3 and C4 are modelled by adjusting the Simapro waste scenario "Municipal solid waste (waste scenario) {EU27}| Treatment of waste | Cut-off, U" with recycling rates according to post-consumer non-packaging recycling rates (R2) used in the Circular footprint formula of PEF, as found in Annex C. The remaining waste is assumed to be incinerated (99%) and landfilled (1%), according to the Swedish average scenario stated in PEF Annex C.

Module D aims to describe potential benefits or loads that can be related to material and energy recovery as well as reuse of materials and energy outside the system boundary.
Here, the D-module has been divided into two parts, the first related to the material-related benefits from recycling and incineration of the product's waste flows leaving the system boundary and the second relates to the benefits of the function of Enduce E1 to reduce the energy consumption from heating of water in showers.
Material-related benefits are calculated using the formula from EN 15804, adjusted with a Y-factor according to PCR 2019:14. Primary material is replaced by recycled materials after they reach functional equivalence. Energy is replaced by the energy from incineration, modelled as only thermal energy from Swedish district heating, based on Swedish statistics (Energiföretagen, n.d.).
Benefits from reduced energy consumption are modelled based on the 43 470 kWh of exported energy in B1, which replaces an average Swedish heating mix (Energimyndigheten, 2022).

Content information

Product components	Weight, kg	Post-consumer material, weight-%	Biogenic material, weight-% and kg C/kg
EPDM Rubber Hoses	0,62	Unknown	0%
PP Plastics	0,4	Unknown	0%
Brass components	0,39	Unknown	0%
Stainless steel, box	9	65,6%	0%
Stainless steel, flange	3	65,6%	0%
Stainless steel, others	4,84	65,6%	0%
Plate heat exchanger	12,8	66,7%	0%
Total	31,05	63,1%	0%
Packaging materials	**Weight, kg**	**Weight-% (versus the product)**	**Weight biogenic carbon, kg C/kg**
Cardboard boxes	0,325	1%	0,15
Wooden pallet + wooden frames	0,58	2%	0,26
TOTAL	0,905	3%	0,41

There are no Substances of Very High Concern (SVHC) exceeding the limits for registration with the European Chemicals Agency (i.e., if the substance constitutes more than 0.1% of the weight of the product).

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Results of the environmental performance indicators

The estimated impact results are only relative statements, which do not indicate the endpoints of the impact categories, exceeding threshold values, safety margins and/or risks.

Mandatory impact category indicators according to EN 15804

Results per functional or declared unit											
Indicator	**Unit**	**A1-A3**	**A4**	**A5**	B1	**B4**	**C1**	**C2**	**C3**	**C4**	**D**
GWP-fossil	kg CO_2 eq.	1,09E+02	2,48E+00	9,71E-03	0,00E+00	5,49E+00	0,00E+00	1,81E-01	6,26E+00	1,80E-03	-1,07E+03
GWP-biogenic	kg CO_2 eq.	7,31E-02	7,02E-04	9,72E-01	0,00E+00	0,00E+00	0,00E+00	5,53E-05	7,93E-01	1,80E-02	-2,08E+01
GWP-luluc	kg CO_2 eq.	1,71E-01	5,43E-05	2,11E-06	0,00E+00	7,66E-03	0,00E+00	3,58E-06	3,09E-05	1,28E-07	-4,80E+01
GWP-total	kg CO_2 eq.	1,09E+02	2,48E+00	9,81E-01	0,00E+00	5,51E+00	0,00E+00	1,81E-01	7,05E+00	1,98E-02	-1,14E+03
ODP	kg CFC 11 eq.	1,70E-06	5,17E-08	8,03E-10	0,00E+00	9,39E-08	0,00E+00	3,95E-09	7,06E-09	4,89E-12	-4,84E-05
AP	mol H^+ eq.	9,46E-01	1,45E-02	2,08E-04	0,00E+00	2,26E-01	0,00E+00	2,28E-04	1,13E-03	3,87E-06	-1,30E+01
EP-freshwater	kg P eq.	7,23E-03	1,94E-06	7,19E-08	0,00E+00	1,03E-03	0,00E+00	1,44E-07	1,16E-06	9,83E-08	-8,13E-02
EP-marine	kg N eq.	1,20E-01	3,66E-03	9,92E-05	0,00E+00	1,21E-02	0,00E+00	5,60E-05	4,91E-04	2,82E-05	-2,67E+00
EP-terrestrial	mol N eq.	1,35E+00	3,97E-02	1,11E-03	0,00E+00	1,67E-01	0,00E+00	5,44E-04	5,38E-03	1,42E-05	-3,92E+01
POCP	kg NMVOC eq.	4,54E-01	1,38E-02	2,98E-04	0,00E+00	5,37E-02	0,00E+00	4,28E-04	1,43E-03	9,47E-06	-8,61E+00
ADP-minerals& metals	kg Sb eq.	1,09E-02	7,73E-08	1,07E-09	0,00E+00	2,89E-03	0,00E+00	6,29E-09	3,83E-08	1,85E-11	-5,74E-02
ADP-fossil	MJ	1,47E+03	3,30E+01	1,14E-01	0,00E+00	1,21E+02	0,00E+00	2,43E+00	9,16E-01	4,55E-03	-8,92E+04
WDP	m^3	2,94E+01	3,00E-02	2,05E-03	0,00E+00	4,83E+00	0,00E+00	2,23E-03	-1,83E-02	1,79E-05	-1,14E+03
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										

Additional mandatory and voluntary impact category indicators

Results per functional or declared unit											
Indicator	**Unit**	**A1-A3**	**A4**	**A5**	**B1**	**B4**	**C1**	**C2**	**C3**	**C4**	**D**
GWP-GHG	kg CO2 eq.	1,11E+02	2,48E+00	1,16E-02	0,00E+00	5,53E+00	0,00E+00	1,81E-01	6,26E+00	1,65E-02	-1,13E+03
PM	diseas e inc.	8,48E-06	1,44E-07	1,81E-09	0,00E+00	5,96E-07	0,00E+00	1,16E-08	1,48E-08	7,08E-11	-1,63E-04
IR	kBq U-235 eq	8,31E+00	5,02E-03	8,14E-05	0,00E+00	2,96E-01	0,00E+00	3,87E-04	8,93E-04	1,69E-05	-2,91E+03
ETP – FW	CTUe	1,16E+03	1,48E+01	2,73E-01	0,00E+00	2,97E+02	0,00E+00	1,08E+00	9,11E+00	6,38E-02	-1,18E+04
HTTP-C	CTUh	1,06E-06	1,91E-10	1,88E-10	0,00E+00	3,34E-08	0,00E+00	1,16E-11	4,89E-10	3,61E-11	-2,23E-06
HTTP-NC	CTUh	7,97E-06	1,68E-08	4,71E-10	0,00E+00	2,88E-06	0,00E+00	1,36E-09	6,88E-09	2,48E-09	-8,02E-05
SQP	Pt	5,45E+02	6,03E-02	4,39E-03	0,00E+00	6,99E+01	0,00E+00	4,62E-03	4,99E-01	7,39E-03	-1,36E+05
Acronyms	GWP-GHG: Global Warming Potential – Greenhouse gases, PM: Particulate Matter, IRP: Ionizing Radiation - Human Health, ETP-FW: Ecotoxicity Potential – Freshwater, HTP-C: Human Toxicity Potential – Cancer, HTP-NC: Human Toxicity Potential – Non-Cancer, SQP: Soil Quality Potential Index										

Disclaimer 1: The results of the environmental impact indicators Abiotic depletion for fossil and non-fossil resources, Water depletion potential, Ecotoxicity-freshwater, Human toxicity-cancer, Human toxicity-non-cancer and Land use shall be used with care as the uncertainties of these results are high or as there is limited experience with the indicator.

Disclaimer 2: The results of the impact categories abiotic depletion of minerals and metals, land use, human toxicity (cancer), human toxicity, noncancer and ecotoxicity (freshwater) may be highly uncertain in LCAs that include capital goods/infrastructure in generic datasets, in case infrastructure/capital goods contribute greatly to the total results. This is because the LCI data of infrastructure/capital goods used to quantify these indicators in currently available generic datasets sometimes lack temporal, technological and geographical representativeness. Caution should be exercised when using the results of these indicators for decision-making purposes.

Disclaimer 3: The indicator GWP-GHG 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.

Disclaimer 4: The indicator Ionising radiation 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.

Disclaimer 5: The use of the results of modules A1-A3 without considering the results of module C is discouraged.

Further details on D-module

The D-module includes benefits from avoided energy use for heating of water in showers during its 30 years of use. The table below divides the D-module into these benefits and any other benefits (from e.g. recycling and energy recovery from incineration at end of life).

The benefits from reducing water heating depend on the energy source for the warm water heating, the behaviour of the users, the losses in the shower and the efficiency of Enduce E1. For this EPD, an average Swedish case has been considered, meaning that the benefits could be significantly larger in regions where warm water heating is based on more fossil-based sources.

Results per functional or declared unit			
Indicator	**Unit**	**D module (benefits from reduced water heating)**	**D-module (other benefits)**
GWP-fossil	kg CO_2 eq.	-2,66E+00	-1,05E+01
GWP-biogenic	kg CO_2 eq.	2,37E-01	2,36E-01
GWP-luluc	kg CO_2 eq.	-1,80E-02	-1,91E-02
GWP-total	kg CO_2 eq.	-2,44E+00	-1,03E+01
ODP	kg CFC 11 eq.	-3,25E-08	-2,25E-07
AP	mol H^+ eq.	-2,23E-01	-2,50E-01
EP-freshwater	kg P eq.	-8,66E-04	-1,28E-03
EP-marine	kg N eq.	-1,04E-02	-1,59E-02
EP-terrestrial	mol N eq.	-1,53E-01	-2,17E-01
POCP	kg NMVOC eq.	-4,36E-02	-8,39E-02
ADP-minerals&metals	kg Sb eq.	-3,07E-03	-3,07E-03
ADP-fossil	MJ	-5,18E+01	-1,34E+02
WDP	m^3	-3,62E+00	-4,04E+00
PM	disease inc.	-6,71E-07	-1,04E-06
IR	kBq U-235 eq	-8,69E-01	-8,98E-01
ETP – FW	CTUe	-2,65E+02	-2,84E+02
HTTP-C	CTUh	-4,27E-08	-8,07E-08
HTTP-NC	CTUh	-3,01E-06	-3,03E-06
SQP	Pt	-1,04E+02	-1,11E+02
GWP-GHG	kg CO2 eq.	-2,67E+00	-1,05E+01

Resource use indicators

Results per functional or declared unit											
Indicator	**Unit**	**A1-A3**	**A4**	**A5**	**B1**	**B4**	**C1**	**C2**	**C3**	**C4**	**D**
PERE	MJ	3,25E+02	8,22E-02	2,45E-03	0,00E+00	1,40E+01	0,00E+00	6,40E-03	3,30E-02	6,55E-04	-8,58E+04
PERM	MJ	1,61E+01	0,00E+00	-1,61E+01	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
PERT	MJ	3,41E+02	8,22E-02	-1,61E+01	0,00E+00	1,40E+01	0,00E+00	6,40E-03	3,30E-02	6,55E-04	-8,58E+04
PENRE	MJ	1,53E+03	3,51E+01	1,22E-01	0,00E+00	1,29E+02	0,00E+00	2,59E+00	9,89E-01	4,81E-03	-7,08E+04
PENRM	MJ	3,23E+01	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	-3,23E+01	0,00E+00	0,00E+00
PENRT	MJ	1,56E+03	3,51E+01	1,22E-01	0,00E+00	1,29E+02	0,00E+00	2,59E+00	-3,13E+01	4,81E-03	-7,08E+04
SM	kg	1,97E+01	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
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	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	0,00E+00
FW	m^3	1,12E+00	1,62E-03	2,87E-03	0,00E+00	1,03E-01	0,00E+00	1,28E-04	7,56E-03	5,86E-07	-1,26E-01
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 and output flow indicators

Waste and output flows refer to flows that are leaving the system of the LCA. In this EPD, only elementary flows (substances) are actually leaving the system. This means that no waste (hazardous, non-hazardous or radioactive) is actually leaving the system boundaries and they are thus declared as zero.

Indicator	Unit	A1-A3	A4	A5	B1	B4	C1	C2	C3	C4	D
Hazardous waste disposed	kg	0	0	0	0	0	0	0	0	0	0
Non-hazardous waste disposed	kg	0	0	0	0	0	0	0	0	0	0
Radioactive waste disposed	kg	0	0	0	0	0	0	0	0	0	0

Results per functional or declared unit										
Indicator	**Unit**	**Tot.A1-A3**	**A4**	**A5**	**B1**	**B4**	**C**	**C2**	**C3**	**C4**
Components for reuse	kg	0	0	0	0	0	0	0	0	0
Material for recycling	kg	4,89	0	0	0	0	0	0	25,6	0
Materials for energy recovery	kg	0	0	0	0	0	0	0	0	0
Exported energy, electricity	MJ	0	0	2,95	0	0	0	0	7,75	0
Exported energy, thermal	MJ	0	0	6,88	156492	0	0	0	18,1	0

Other scenarios for climate benefits from reduced water heating energy use

The potential environmental benefits in the D-module depend on the energy source for the warm water heating, the behaviour of the users, the losses in the shower and the efficiency of Enduce E1. Here are presented the potential climate benefits in a number of alternative scenarios.

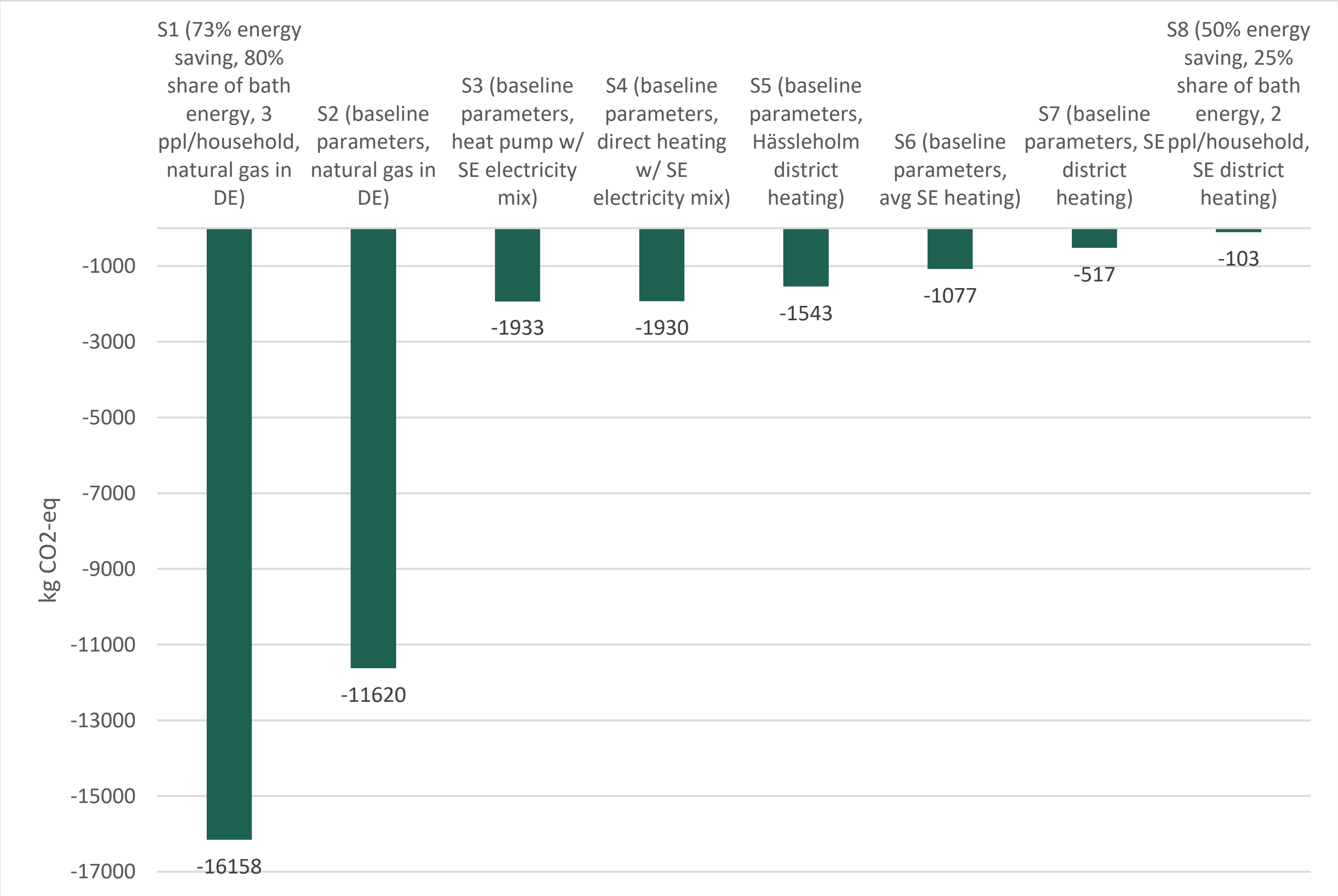
In the main EPD results, an average Swedish scenario was considered, with:

- 1150 kWh household heating energy consumption per person and year (Energimyndigheten, 2009)
- 60% of this heating is used for household showers (Energimyndigheten, 2009)
- An average household size among Enduce's customers is assumed to be 3 people
    - This estimate is based on the fact that the customer's economic savings increase with more residents in the household and that an average Swedish family size is 3,5 people, or 2,5 people in a divorced family
- The net efficiency of Enduce E1 is 70% (in a shower with walls/curtains) (Research Institutes of Sweden AB, 2022)
- The energy system for warm water heating was modelled based on statistics from the Swedish Energy Authority (Energimyndigheten, 2022)

Alternative scenarios are defined according to the table below, where S2-S6 use baseline parameter values but with different energy systems for water heating. Additionally, scenarios S1 and S7 are extreme scenarios, where the parameters are maximized/minimized to explore the potential range of benefits.

	Energy consumption, kWh/person/year	Share of bath energy	ppl/ household	Net efficiency of Enduce E1	Energy system
S1 – Extreme scenario - Heating with natural gas in Germany	1150	80%	3	73%	Natural gas
S2 – Heating with natural gas in Germany	1150	60%	3	70%	Natural gas
S3 – Heating with heat pump using Swedish electricity mix	1150	60%	3	70%	Heat pump
S4 – Heating with direct electricity using Swedish electricity mix	1150	60%	3	70%	Direct electricity
S5 – Heating with Swedish district heating (Hässleholm)	1150	60%	3	70%	District heating
S6 – Heating with average mix of Swedish heating sources	1150	60%	3	70%	Average SE mix
S7 – Heating with Swedish district heating (average)	1150	60%	3	70%	District heating
S8 – Extreme scenario - Heating with Swedish district heating (average)	1150	25%	2	50%	District heating

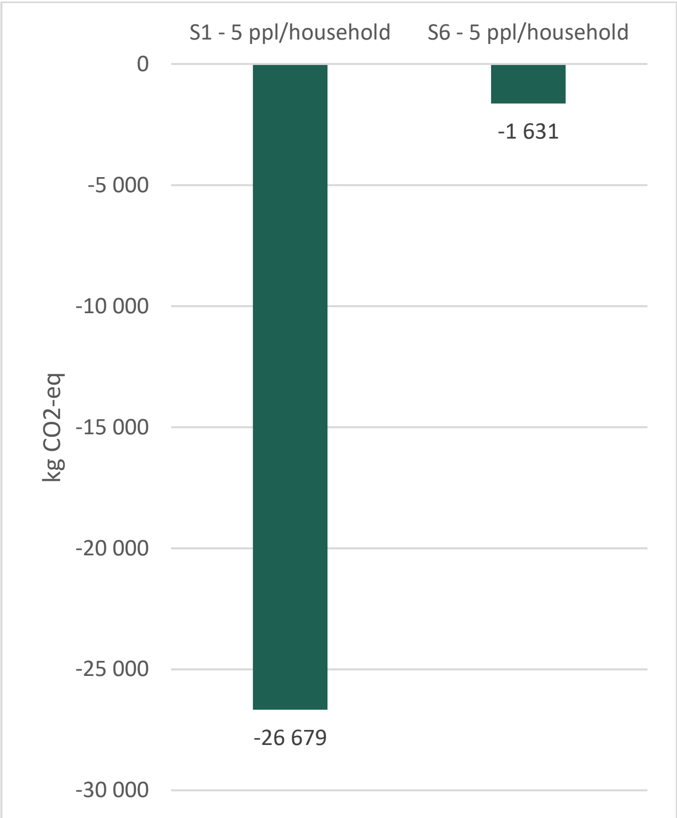
The figure below summarises the environmental benefits from reduced water heating energy use. With baseline parameter values (S2-S7) the benefits can range from ca 0,6 – 12 ton CO2-eq. over 30 years. In the extreme scenarios, the benefits can reach as low as ca 0,1 ton CO2-eq. in a small household with low warm water needs run on district heating, or as high as ca 16,7 ton CO2-eq. in a larger regular household with large warm water needs run on natural gas in Germany. With 5 people per household, the benefits can reach as high as 26,7 ton CO2-eq.



Lastly, two more scenarios were investigated. All previous scenarios have three or fewer people per household, which is why scenarios S1-5 and S6-5 were defined, which are simply scenario S1 and S6, respectively, but with five instead of three people per household.

S1-5 – Same as S1 but with 5 ppl/household	1150	80%	5	73%	Natural gas
S6-5 – Same as S6 but with 5 ppl/household	1150	60%	5	70%	Average SE mix

The benefits in these cases are ca 27 ton CO2-eq in S1-5 and 1,6 ton CO2-eq. in S6-5, as can be seen in the figure below.



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