ENGINEERING TOMORROW

Environmental **Product Declaration**

ABQM 4.0 DN 15 - 32 with Novocon S

EPD issued	27.01.2023
EPD expires	27.01.2028
EPD author	Danfoss Climate Solutions
EPD type	Cradle-to-grave
Declared unit	One product over its Reference Service Life
Products included	ABQM 4.0. DN 15, 20, 25 & 32 pressure independent valve with NovoconS actuator
Manufacturing Location	Ljubljana, Slovenia
Use Location	European Union
Application	HVAC systems
Mass	Depending on the size (shown in product composition)
Dimensions (H×W×D)	Depending on the size (shown in product composition)
Verification	[ ] External [X] Internal [ ] None
Produced to	Danfoss Product Category Rules (2022-09)
Internal independent verifier	Danfoss Power electronics 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.

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, EN 15804+A2:2019 and EN 50598-3:2015.

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-grave' and includes all relevant modules: production (A1-A3), shipping (A4) and installation (A5); operational energy use (B6); 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. Modules concerning use, maintenance, repair, replacement, refurbishment (B1-B5) 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	**X**	MNR	**X**	**X**	**X**	**X**	**X**

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

Product Description

AB-QM 4.0 DN15-DN32 valve: The Danfoss AB-QM is a Pressure Independent Control Valve (PICV) that combines high accuracy and durability with market leading user-friendliness. Pressure independent valves are control valves with a dynamic balancing function. An in-built pressure controller keeps a constant differential pressure over the control valve, ensuring full authority and automatic flow limitation. By combining two functions in one, control and dynamic hydronic balance, Danfoss AB-QM provide a cost-efficient solution for the challenges faced by forward-looking designers of HVAC systems.

NovoCon S actuator: NovoCon S is a high accuracy multi-functional field bus actuator, specifically designed for use with the Pressure Independent Balancing Control Valve type AB-QM in sizes from DN 15-32. Actuator can be directly connected to Building Management Systems (BMS) using BACnet or Modbus bus-communication. This enables a whole new dimension to HVAC control, offering designers, system integrators and building owners many features and benefits. The actuators enable continuous monitoring, active energy management and preventive maintenance at the highest comfort level and lowest operating costs. The digital actuators can be used in many building types such as offices, hotels, hospitals and other HVAC systems. See more information on Danfoss product store and Danfoss product store.

See more information on Danfoss product store and Danfoss product store.

Figure 1: The illustration of the valve & actuator.

Reference Service Life

For the purpose of this EPD the reference service life (RSL) of the product is considered to be 10 years. However, with the correct maintenance, the lifetime of the product can reach over 15 years.

Intended market

The intended market of this study is European Union, and the baseline scenario involves the distribution, installation, and end-of-life in European Union. With regards to the use stage and the end-of-life stage, this EPD is not representative of regions other than European Union.

Product Description

Table 2: Product composition ABQM 4.0 DN 15 - 32 & Novocon S

	DN 15 & Novocon S		DN 20 & Novocon S		DN 25 & Novocon S		DN 32 & Novocon S	
Material	**Mass (kg)**	**(%)**	**Mass (kg)**	**(%)**	**Mass (kg)**	**(%)**	**Mass (kg)**	**(%)**
Metals	**0,531**	**61,45%**	**0,741**	**68,95%**	**1,165**	**76,51%**	**1,608**	**75,81%**
Steel (excl. stainless steel)	0,006	0,68%	0,006	0,55%	0,006	0,39%	0,006	0,28%
Stainless steel	0,015	1,68%	0,013	1,16%	0,075	4,93%	0,112	5,30%
Brass	0,510	59,09%	0,722	67,23%	1,085	71,20%	1,489	70,23%
Plastics & Rubbers	**0,273**	**31,57%**	**0,273**	**25,44%**	**0,298**	**19,53%**	**0,318**	**14,97%**
ABS	0,003	0,38%	0,003	0,28%	0,003	0,20%	0,003	0,14%
EPDM_Ext	0,004	0,47%	0,005	0,47%	0,007	0,46%	0,007	0,33%
Iglidur	0,0002	0,02%	0,0002	0,02%	0,0002	0,01%	0,0002	0,01%
POM	0,156	18,02%	0,156	14,48%	0,156	10,22%	0,156	7,34%
PBT_GF	0,074	8,62%	0,074	6,92%	0,074	4,88%	0,074	3,51%
PP	0,017	2,01%	0,017	1,63%	0,040	2,61%	0,060	2,81%
PVC	0,017	1,97%	0,017	1,58%	0,017	1,12%	0,017	0,80%
SBR_Ext	0,001	0,07%	0,001	0,06%	0,001	0,04%	0,001	0,03%
Natural materials	**0,009**	**1,09%**	**0,009**	**0,88%**	**0,009**	**0,62%**	**0,009**	**0,42%**
Paper and cardboard	0,009	1,09%	0,009	0,88%	0,009	0,62%	0,009	0,42%
Electrical/electronic	**0,051**	**5,89%**	**0,051**	**4,73%**	**0,051**	**3,34%**	**0,051**	**2,40%**
Actives	0,002	0,20%	0,002	0,16%	0,002	0,11%	0,002	0,08%
Electromechanics	0,002	0,21%	0,002	0,17%	0,002	0,12%	0,002	0,08%
Passives	0,038	4,45%	0,038	3,58%	0,038	2,52%	0,038	1,81%
PWBs	0,009	1,03%	0,009	0,83%	0,009	0,58%	0,009	0,42%
Total material	**0,863**	**100,00%**	**1,075**	**100,00%**	**1,523**	**100,00%**	**1,985**	**93,61%**
Packaging material	**Mass (kg)**	**%**	**Mass (kg)**	**%**	**Mass (kg)**	**%**	**Mass (kg)**	**%**
Paper and cardboard	0,128	96,96%	0,128	96,96%	0,119	96,75%	0,132	97,05%
PE_Film	0,004	3,04%	0,004	3,04%	0,004	3,25%	0,004	2,95%
Total packaging	**0,132**	**100,00%**	**0,132**	**100,00%**	**0,123**	**100,00%**	**0,136**	**100,00%**
Total material & packaging	**Mass (kg)**	**%**	**Mass (kg)**	**%**	**Mass (kg)**	**%**	**Mass (kg)**	**%**
Total material	0,863	86,77%	1,075	89,09%	1,523	92,52%	1,985	93,61%
Total packaging	0,132	13,23%	0,132	10,91%	0,123	7,48%	0,136	6,39%
Total material & packaging	**0,995**	**100,00%**	**1,206**	**100,00%**	**1,646**	**100,00%**	**2,120**	**100,00%**

Table 3: Product composition ABQM 4.0 DN 15 -32

DN 15	DN 20	DN 25	DN 32

Product Description

Material	Mass (kg)	(%)	Mass (kg)	(%)	Mass (kg)	(%)	Mass (kg)	(%)
Metals	**0,499**	**94,71%**	**0,709**	**96,11%**	**1,133**	**95,54%**	**1,576**	**95,54%**
Stainless steel	0,010	1,90%	0,010	1,08%	0,071	5,95%	0,108	6,55%
Brass	0,489	92,81%	0,701	95,02%	1,063	89,60%	1,468	89,00%
Plastics & Rubbers	**0,022**	**4,21%**	**0,023**	**3,12%**	**0,047**	**3,98%**	**0,067**	**4,07%**
ABS	0,003	0,63%	0,003	0,41%	0,003	0,25%	0,003	0,18%
EPDM_Ext	0,002	0,39%	0,003	0,42%	0,005	0,42%	0,005	0,31%
Iglidur	0,0002	0,04%	0,0002	0,03%	0,0002	0,02%	0,0002	0,01%
PP	0,017	3,16%	0,017	2,27%	0,039	3,28%	0,059	3,57%
Natural materials	**0,006**	**1,08%**	**0,006**	**0,77%**	**0,006**	**0,48%**	**0,006**	**0,39%**
Paper and cardboard	0,006	1,08%	0,006	0,77%	0,006	0,48%	0,006	0,39%
Total material	**0,526**	**100,00%**	**0,738**	**100,00%**	**1,186**	**100,00%**	**1,649**	**100,00%**
Packaging material	**Mass (kg)**	**%**	**Mass (kg)**	**%**	**Mass (kg)**	**%**	**Mass (kg)**	**%**
Paper and cardboard	0,087	95,59%	0,087	95,59%	0,057	93,39%	0,057	93,42%
PE_Film	0,004	4,41%	0,004	4,41%	0,004	6,61%	0,004	6,58%
Total packaging	**0,091**	**100,00%**	**0,091**	**100,00%**	**0,061**	**100,00%**	**0,061**	**100,00%**
Total material & packaging	**Mass (kg)**	**%**	**Mass (kg)**	**%**	**Mass (kg)**	**%**	**Mass (kg)**	**%**
Total material	0,526	85,30%	0,738	89,04%	1,186	95,15%	1,649	96,45%
Total packaging	0,091	14,70%	0,091	10,96%	0,061	4,85%	0,061	3,55%
Total material & packaging	**0,617**	**100,00%**	**0,828**	**100,00%**	**1,247**	**100,00%**	**1,710**	**100,00%**

Product Description

Table 4: Product composition Novocon S

Material	Mass (kg)	(%)
Metals	**0,032**	**9,69%**
Steel (excl. stainless steel)	0,006	1,79%
Stainless steel	0,005	1,36%
Brass	0,022	6,54%
Plastics & Rubbers	**0,250**	**75,78%**
EPDM_Ext	0,002	0,61%
POM	0,156	47,11%
PBT_GF	0,074	22,52%
PP	0,001	0,22%
PVC	0,017	5,15%
SBR_Ext	0,001	0,18%
Natural materials	**0,004**	**1,14%**
Paper and cardboard	0,004	1,14%
Electrical/electronic	**0,044**	**13,39%**
Actives	0,005	1,46%
Electromechanics	0,001	0,22%
Passives	0,030	9,02%
PWBs	0,009	2,69%
Total material	**0,330**	**100,00%**
Packaging material	**Mass (kg)**	**%**
Paper and cardboard	0,041	100,00%
Total packaging	**0,041**	**100,00%**
Total material & packaging	**Mass (kg)**	**%**
Total material	0,330	88,98%
Total packaging	0,041	11,02%
Total material & packaging	**0,371**	**100,00%**

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 GaBi database version 2022.

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.

System boundaries

The results in this EPD are split into life cycle modules following EN 15804 (Figure 1): production (A1-A3), distribution (A4), use (B6) 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).

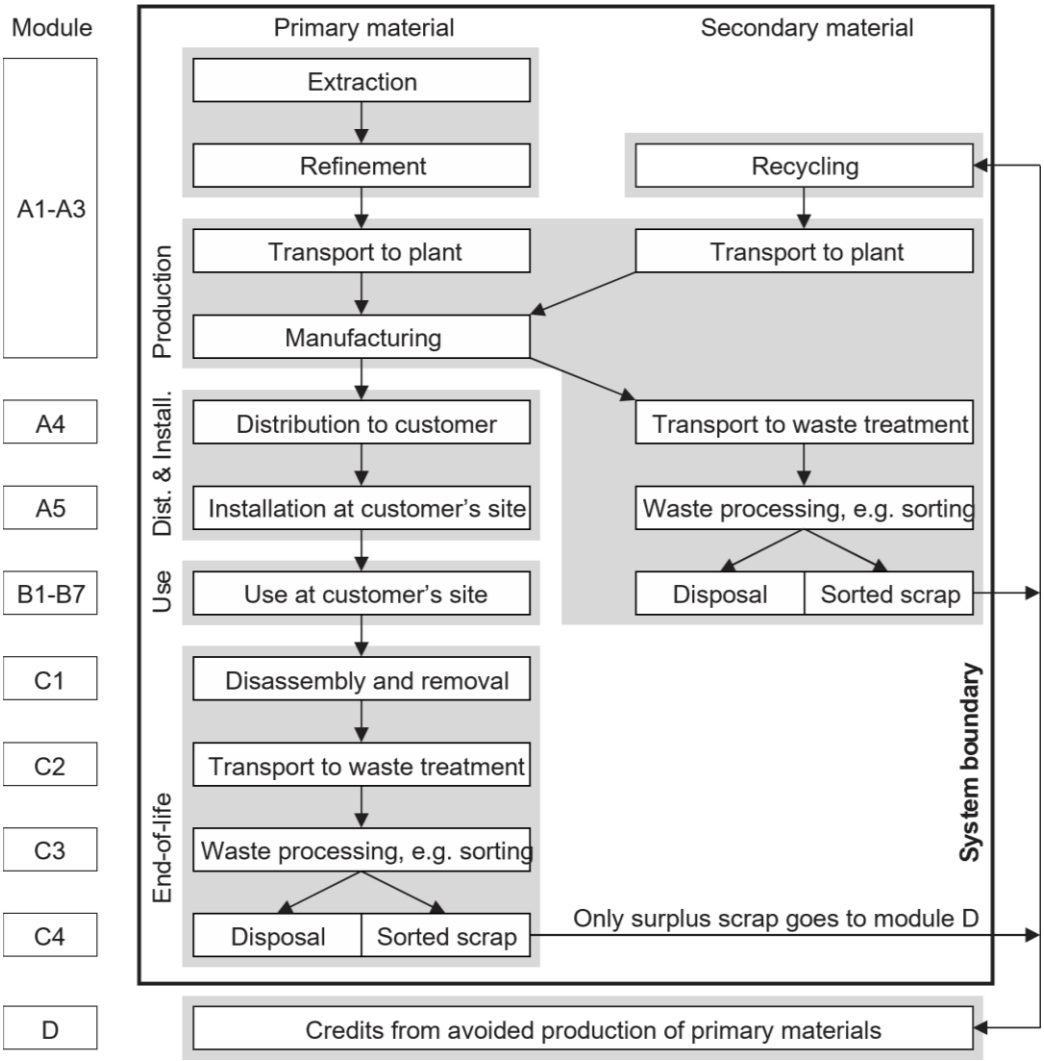

Figure 2: Modular structure used in this EPD (following EN 15804+A2)

Overview of LCA study

Product and packaging manufacture (A1-A3)

Final manufacturing occurs in the Ljubljana plant, China The facility is certified according to IATF 16949 compliant, ISO 14001, ISO 9001, PED/PESR, UL & MID. Where waste generated on-site is recyclable, it is separated and recycled. For further information, see here. The product is shipped in the packaging as described in Table 3. All packaging materials can be safely recycled or incinerated if appropriate local facilities are available.

Table 5: Biogenic carbon content in product and packaging ABQM 4.0 DN 15 & Novocon S

	Total (excluding recycling)
Biogenic carbon content in product [kg]	0,00425
Biogenic carbon content in accompanying packaging [kg]	0,0574

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

Table 6: Biogenic carbon content in product and packaging ABQM 4.0 DN 20 & Novocon S

	Total (excluding recycling)
Biogenic carbon content in product [kg]	0,00425
Biogenic carbon content in accompanying packaging [kg]	0,0574

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

Table 7: Biogenic carbon content in product and packaging ABQM 4.0 DN 25 & Novocon S

	Total (excluding recycling)
Biogenic carbon content in product [kg]	0,00425
Biogenic carbon content in accompanying packaging [kg]	0,0536

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

Table 8: Biogenic carbon content in product and packaging ABQM 4.0 DN 32 & Novocon S

	Total (excluding recycling)
Biogenic carbon content in product [kg]	0,00455
Biogenic carbon content in accompanying packaging [kg]	0,0592

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

Shipping and installation (A4-A5)

This ABQM 4.0 with Novocon S actuator is sold in the European union, an average distance of 1151 km by truck it was calculated based on 2021 sales data between the factory and the final customer. It is an average for all 4 dimensions.

Module A5 includes disposal of packaging materials only. The product is assumed to be installed by hand. Energy use in handheld tools during installation is not included as it falls below the cut-off criteria in the Core Rules.

Use phase (B1-B6)

The Reference Service Life (RSL) applied in this EPD is 10 years. The use electricity consumption is size independent, so the use case representative for all 4 dimensions (DN 15, 20, 25 & 32).

Overview of LCA study

Table 9: Use phase data for ABQM 4.0 with Novocon S

For ABQM 4.0 DN 15, 20, 25 & 32 Season duration: 0,5 year; Actuator operation time per day: 10 hours			
Aspect	Value	Unit	Comment / Source
Power consumption "in operation"	1,2	W	Danfoss Novocon S datasheet
Power consumption "on standby"	0,7	W	Danfoss Novocon S datasheet
% of time actuator is working (moving)	6	%	Danfoss team
% of time actuator is in standby	94%	%	Danfoss team
Yearly total time "in operation"	1825	h/year	Calculated
Yearly total time "working"	110	h/year	Calculated
Yearly total time "on standby"	1716	h/year	Calculated
NovoCon S Power consumption Working	0,13	kWh/year	Calculated
NovoCon S Power consumption STB	1,2	kWh/year	Calculated
NovoCon S Power consumption total	1,33	kWh/year	Calculated

The scope of this study is targeted for the European Union market; therefore, the product under study is sold and used in European Union. Sales also occur outside of European Union, which is important to note considering the impact the electricity grid mix can have on the emissions in the use phase. To represent the EU market for the purpose of this assessment, an average EU-27 CO_2 factor from GaBi database (2022) is applied.

For this reason, 2 alternative scenarios were made to represent the use phase for the USA and China market.

Table 10: CO2 emissions per use phase location for ABQM 4.0 with Novocon S

Location of use	Use phase, kgCO2eq (GWPF)
European Union (Baseline scenario)	4,72E00
China	1,08E01
USA	6,87E00

The major limitation of the impact calculations for the use phase is that the electricity grid mix in use is assumed to remain at the same carbon intensity over time. Following the plans for the decarbonization of the grid across EU, USA and China, the environmental impacts are expected to decrease over time within the course of the next 10 years. However, as decarbonization will occur in the future and as the pace of decarbonization is uncertain, the use of the emission intensity of today's grid should prove to be a "worst-case", conservative assumption.

End-of-life (C1-C4)

The standard end-of-life procedure from EN 50598-3 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.

Overview of LCA study

- 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).

Two scenarios are examined for the end-of-life.

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 (C3.1, C4.1, D.1)

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 (C3.2, C4.2, D.2).

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 one-unit ABQM 4.0 valve (DN 15, 20, 25, 32) with Novocon S actuator. Figure 3-6 presents the environmental impact of the ABQM 4.0 valve (DN 15, 20, 25, 32) with Novocon S actuator across a number of environmental impact categories (following EN 15804+A2:2019) per life cycle stage, over its full 10-year life cycle, including Global Warming Potential.

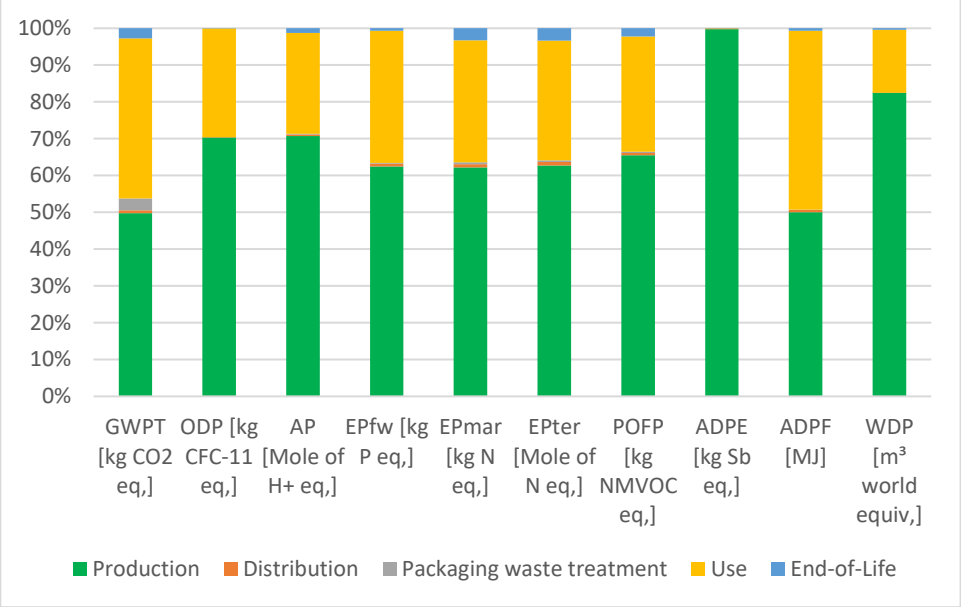

Figure 3: Breakdown of environmental impacts by life cycle stages for ABQM 4.0 DN 15 with Novocon S (see Table 15 for descriptions of environmental impact indicators).

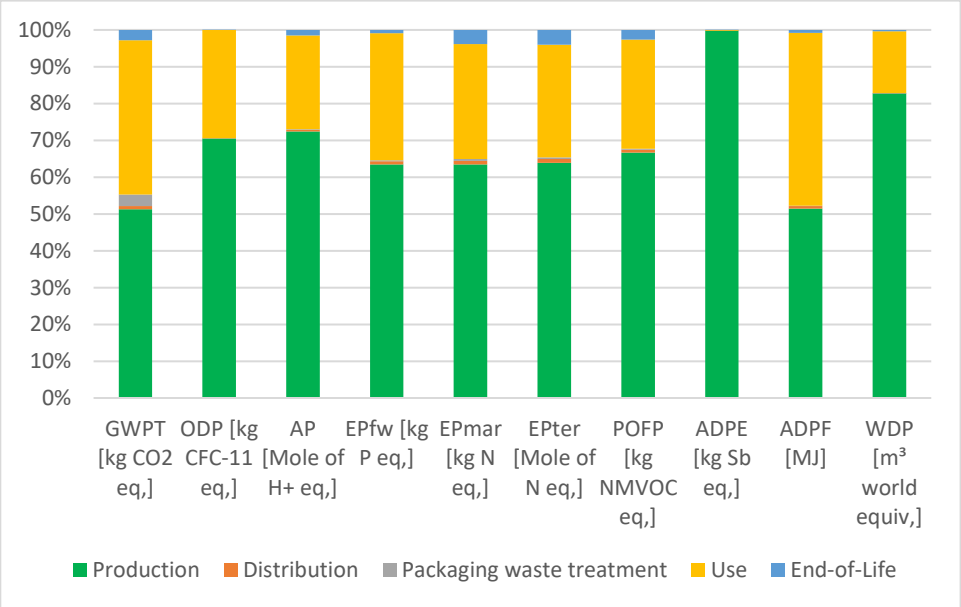

Figure 4: Breakdown of environmental impacts by life cycle stages ABQM 4.0 DN 20 with Novocon S (see Table 15 for descriptions of environmental impact indicators).

Environmental performance

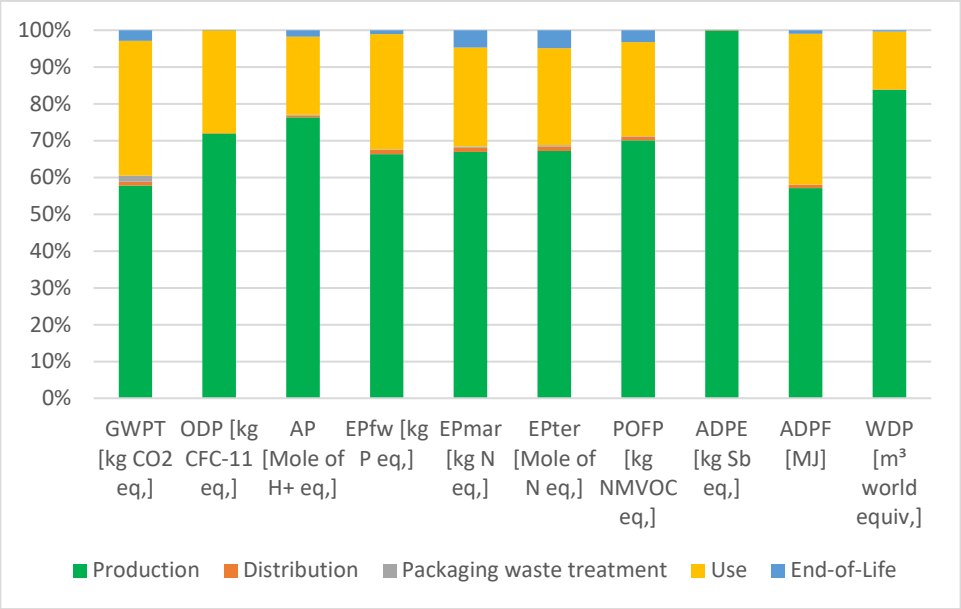

Figure 5: Breakdown of environmental impacts by life cycle stages ABQM 4.0 DN 25 with Novocon S (see Table 15 for descriptions of environmental impact indicators).

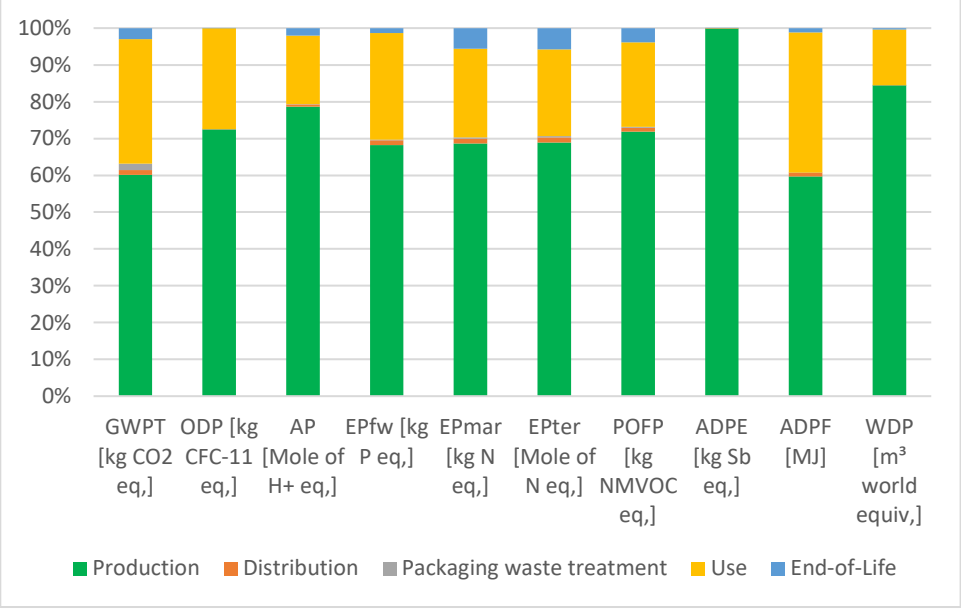

Figure 6: Breakdown of environmental impacts by life cycle stages ABQM 4.0 DN 32 with Novocon S (see Table 15 for descriptions of environmental impact indicators).

Table 11: Environmental impact indicators ABQM 4.0 DN 15 & Novocon S

	Production	Distribution	Packaging waste treatment	Use	End-of-Life						(not included in Figure 4)	
Life cycle stages based on EN 15804+A2	**A1-A3**	**A4**	**A5**	**B6**	**C1**	**C2**	**C3.1** Recycling	**C3.2** Landfill	**C4.1** Recycling	**C4.2** Landfill	**D.1** Recycling	**D.2** Landfill
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	Use of the product over its lifetime e.g., 10 years	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.]	5,45E+00	8,31E-02	3,55E-01	4,76E+00	N/A	7,76E-03	7,30E-02	N/A	2,15E-01	3,64E-02	-7,94E-01	1,38E-01
GWPF [kg CO2 eq.]	5,79E+00	8,25E-02	1,15E-02	4,72E+00	N/A	7,76E-03	7,25E-02	N/A	2,15E-01	3,64E-02	-7,93E-01	1,38E-01
GWPB [kg CO2 eq.]	-3,44E-01	0,00E+00	3,44E-01	4,26E-02	N/A	0,00E+00	0,00E+00	N/A	0,00E+00	0,00E+00	0,00E+00	0,00E+00
GWPLULUC [kg CO2 eq.]	4,28E-03	5,65E-04	7,85E-06	1,00E-03	N/A	1,84E-07	4,58E-04	N/A	5,52E-07	2,57E-05	-5,07E-04	3,55E-04
ODP [kg CFC-11 eq.]	1,65E-10	8,23E-15	8,66E-16	6,92E-11	N/A	8,90E-19	8,32E-14	N/A	2,21E-14	4,70E-14	-1,41E-11	1,24E-12
AP [Mole of H+ eq.]	2,66E-02	1,51E-04	6,43E-05	1,03E-02	N/A	1,15E-05	4,22E-04	N/A	4,40E-05	1,68E-04	-2,98E-03	3,14E-03
EPfw [kg P eq.]	2,40E-05	2,99E-07	7,31E-08	1,38E-05	N/A	1,65E-09	2,57E-07	N/A	8,10E-09	3,70E-06	-1,47E-06	9,05E-07
EPmar [kg N eq.]	4,35E-03	5,99E-05	3,28E-05	2,32E-03	N/A	4,69E-06	2,03E-04	N/A	1,80E-05	5,31E-05	-4,16E-04	1,81E-04
EPter [Mole of N eq.]	4,71E-02	6,88E-04	3,59E-04	2,44E-02	N/A	5,18E-05	2,25E-03	N/A	2,32E-04	5,73E-04	-4,52E-03	1,93E-03
POFP [kg NMVOC eq.]	1,31E-02	1,33E-04	6,10E-05	6,27E-03	N/A	1,09E-05	3,86E-04	N/A	4,54E-05	1,39E-04	-1,52E-03	5,48E-04
ADPE [kg Sb eq.]	5,41E-04	8,45E-09	3,73E-09	1,29E-06	N/A	2,71E-10	8,26E-09	N/A	4,73E-10	2,54E-09	-5,74E-05	3,28E-04
ADPF [MJ]	8,78E+01	1,10E+00	1,50E-01	8,54E+01	N/A	1,10E-01	9,84E-01	N/A	7,03E-02	5,07E-01	-1,90E+01	-6,76E-01
WDP [m^3 world equiv.]	5,11E+00	9,38E-04	8,79E-04	1,06E+00	N/A	1,29E-05	1,93E-03	N/A	2,33E-02	8,12E-04	-7,25E-02	1,04E-01

Table 12: Environmental impact indicators ABQM 4.0 DN 20 & Novocon S

	Production	Distribution	Packaging waste treatment	Use	End-of-Life						(not included in Figure 4)	
Life cycle stages based on EN 15804+A2	**A1-A3**	**A4**	**A5**	**B6**	**C1**	**C2**	**C3.1** Recycling	**C3.2** Landfill	**C4.1** Recycling	**C4.2** Landfill	**D.1** Recycling	**D.2** Landfill
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	Use of the product over its lifetime e.g., 10 years	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.]	5,83E+00	1,01E-01	3,55E-01	4,76E+00	N/A	9,70E-03	9,27E-02	N/A	2,18E-01	4,16E-02	-8,17E-01	2,14E-01
GWPF [kg CO2 eq.]	6,17E+00	1,00E-01	1,15E-02	4,72E+00	N/A	9,70E-03	9,21E-02	N/A	2,18E-01	4,16E-02	-8,16E-01	2,13E-01
GWPB [kg CO2 eq.]	-3,44E-01	0,00E+00	3,44E-01	4,26E-02	N/A	0,00E+00	0,00E+00	N/A	0,00E+00	0,00E+00	0,00E+00	0,00E+00
GWPLULUC [kg CO2 eq.]	4,93E-03	6,86E-04	7,85E-06	1,00E-03	N/A	2,30E-07	5,91E-04	N/A	5,63E-07	3,17E-05	-5,23E-04	5,07E-04
ODP [kg CFC-11 eq.]	1,66E-10	1,00E-14	8,66E-16	6,92E-11	N/A	1,11E-18	8,51E-14	N/A	2,23E-14	5,46E-14	-1,35E-11	2,01E-12
AP [Mole of H+ eq.]	2,92E-02	1,83E-04	6,43E-05	1,03E-02	N/A	1,44E-05	5,41E-04	N/A	4,43E-05	2,02E-04	-3,16E-03	4,47E-03
EPfw [kg P eq.]	2,53E-05	3,64E-07	7,31E-08	1,38E-05	N/A	2,06E-09	3,28E-07	N/A	8,17E-09	3,71E-06	-1,49E-06	1,28E-06
EPmar [kg N eq.]	4,71E-03	7,28E-05	3,28E-05	2,32E-03	N/A	5,86E-06	2,61E-04	N/A	1,81E-05	6,46E-05	-4,32E-04	2,65E-04
EPter [Mole of N eq.]	5,09E-02	8,37E-04	3,59E-04	2,44E-02	N/A	6,47E-05	2,89E-03	N/A	2,34E-04	6,99E-04	-4,69E-03	2,82E-03
POFP [kg NMVOC eq.]	1,41E-02	1,62E-04	6,10E-05	6,27E-03	N/A	1,36E-05	4,97E-04	N/A	4,57E-05	1,67E-04	-1,58E-03	8,14E-04
ADPE [kg Sb eq.]	7,27E-04	1,03E-08	3,73E-09	1,29E-06	N/A	3,39E-10	1,02E-08	N/A	4,77E-10	2,94E-09	-7,36E-05	4,64E-04
ADPF [MJ]	9,36E+01	1,34E+00	1,50E-01	8,54E+01	N/A	1,37E-01	1,24E+00	N/A	7,09E-02	5,77E-01	-1,97E+01	-2,01E-01
WDP [m^3 world equiv.]	5,23E+00	1,14E-03	8,79E-04	1,06E+00	N/A	1,61E-05	2,15E-03	N/A	2,35E-02	1,16E-03	-7,88E-02	1,49E-01

Table 13: Environmental impact indicators ABQM 4.0 DN 25 & Novocon S

	Production	Distribution	Packaging waste treatment	Use	End-of-Life						(not included in Figure 4)	
Life cycle stages based on EN 15804+A2	**A1-A3**	**A4**	**A5**	**B6**	**C1**	**C2**	**C3.1** Recycling	**C3.2** Landfill	**C4.1** Recycling	**C4.2** Landfill	**D.1** Recycling	**D.2** Landfill
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	Use of the product over its lifetime e.g., 10 years	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.]	7,50E+00	1,38E-01	2,13E-01	4,76E+00	N/A	1,37E-02	1,34E-01	N/A	2,23E-01	5,37E-02	-1,19E+00	3,74E-01
GWPF [kg CO2 eq.]	7,70E+00	1,37E-01	1,08E-02	4,72E+00	N/A	1,37E-02	1,33E-01	N/A	2,23E-01	5,37E-02	-1,19E+00	3,73E-01
GWPB [kg CO2 eq.]	-2,02E-01	0,00E+00	2,02E-01	4,26E-02	N/A	0,00E+00	0,00E+00	N/A	0,00E+00	0,00E+00	0,00E+00	0,00E+00
GWPLULUC [kg CO2 eq.]	5,92E-03	9,37E-04	7,35E-06	1,00E-03	N/A	3,26E-07	8,70E-04	N/A	5,82E-07	4,42E-05	-1,46E-03	7,75E-04
ODP [kg CFC-11 eq.]	1,78E-10	1,37E-14	8,11E-16	6,92E-11	N/A	1,58E-18	8,92E-14	N/A	2,26E-14	7,17E-14	-1,38E-11	3,18E-12
AP [Mole of H+ eq.]	3,70E-02	2,50E-04	6,02E-05	1,03E-02	N/A	2,04E-05	7,92E-04	N/A	4,49E-05	2,76E-04	-5,50E-03	6,83E-03
EPfw [kg P eq.]	2,93E-05	4,97E-07	6,84E-08	1,38E-05	N/A	2,92E-09	4,76E-07	N/A	8,30E-09	4,04E-06	-1,97E-06	1,94E-06
EPmar [kg N eq.]	5,78E-03	9,94E-05	3,07E-05	2,32E-03	N/A	8,31E-06	3,83E-04	N/A	1,83E-05	8,90E-05	-7,52E-04	4,27E-04
EPter [Mole of N eq.]	6,24E-02	1,14E-03	3,36E-04	2,44E-02	N/A	9,18E-05	4,25E-03	N/A	2,37E-04	9,68E-04	-8,15E-03	4,54E-03
POFP [kg NMVOC eq.]	1,72E-02	2,21E-04	5,70E-05	6,27E-03	N/A	1,93E-05	7,29E-04	N/A	4,61E-05	2,28E-04	-2,60E-03	1,33E-03
ADPE [kg Sb eq.]	1,06E-03	1,40E-08	3,49E-09	1,29E-06	N/A	4,80E-10	1,44E-08	N/A	4,85E-10	3,84E-09	-1,02E-04	6,96E-04
ADPF [MJ]	1,19E+02	1,82E+00	1,40E-01	8,54E+01	N/A	1,95E-01	1,79E+00	N/A	7,19E-02	7,41E-01	-2,62E+01	6,35E-01
WDP [m^3 world equiv.]	5,64E+00	1,56E-03	8,22E-04	1,06E+00	N/A	2,28E-05	2,62E-03	N/A	2,40E-02	1,84E-03	-2,30E-01	2,23E-01

Table 14: Environmental impact indicators ABQM 4.0 DN 32 & Novocon S

	Production	Distribution	Packaging waste treatment	Use	End-of-Life						(not included in Figure 4)	
Life cycle stages based on EN 15804+A2	**A1-A3**	**A4**	**A5**	**B6**	**C1**	**C2**	**C3.1** Recycling	**C3.2** Landfill	**C4.1** Recycling	**C4.2** Landfill	**D.1** Recycling	**D.2** Landfill
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	Use of the product over its lifetime e.g., 10 years	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.]	8,46E+00	1,78E-01	2,42E-01	4,76E+00	N/A	1,79E-02	1,77E-01	N/A	2,23E-01	6,60E-02	-1,45E+00	5,36E-01
GWPF [kg CO2 eq.]	8,68E+00	1,77E-01	1,18E-02	4,72E+00	N/A	1,79E-02	1,76E-01	N/A	2,23E-01	6,59E-02	-1,45E+00	5,35E-01
GWPB [kg CO2 eq.]	-2,30E-01	0,00E+00	2,30E-01	4,26E-02	N/A	0,00E+00	0,00E+00	N/A	0,00E+00	0,00E+00	0,00E+00	0,00E+00
GWPLULUC [kg CO2 eq.]	7,04E-03	1,21E-03	8,08E-06	1,00E-03	N/A	4,25E-07	1,16E-03	N/A	5,82E-07	5,72E-05	-2,06E-03	1,07E-03
ODP [kg CFC-11 eq.]	1,83E-10	1,76E-14	8,92E-16	6,92E-11	N/A	2,06E-18	9,34E-14	N/A	2,26E-14	8,92E-14	-1,41E-11	4,54E-12
AP [Mole of H+ eq.]	4,35E-02	3,22E-04	6,62E-05	1,03E-02	N/A	2,66E-05	1,05E-03	N/A	4,49E-05	3,52E-04	-7,11E-03	9,43E-03
EPfw [kg P eq.]	3,25E-05	6,40E-07	7,53E-08	1,38E-05	N/A	3,81E-09	6,29E-07	N/A	8,31E-09	4,33E-06	-2,26E-06	2,67E-06
EPmar [kg N eq.]	6,62E-03	1,28E-04	3,38E-05	2,32E-03	N/A	1,08E-05	5,10E-04	N/A	1,83E-05	1,14E-04	-9,67E-04	5,98E-04
EPter [Mole of N eq.]	7,14E-02	1,47E-03	3,70E-04	2,44E-02	N/A	1,20E-04	5,65E-03	N/A	2,37E-04	1,25E-03	-1,05E-02	6,36E-03
POFP [kg NMVOC eq.]	1,96E-02	2,85E-04	6,27E-05	6,27E-03	N/A	2,52E-05	9,70E-04	N/A	4,61E-05	2,91E-04	-3,29E-03	1,87E-03
ADPE [kg Sb eq.]	1,42E-03	1,81E-08	3,84E-09	1,29E-06	N/A	6,27E-10	1,88E-08	N/A	4,85E-10	4,77E-09	-1,33E-04	9,56E-04
ADPF [MJ]	1,34E+02	2,35E+00	1,54E-01	8,54E+01	N/A	2,54E-01	2,35E+00	N/A	7,19E-02	9,08E-01	-3,12E+01	1,48E+00
WDP [m^3 world equiv.]	5,93E+00	2,01E-03	9,05E-04	1,06E+00	N/A	2,97E-05	3,10E-03	N/A	2,40E-02	2,56E-03	-3,30E-01	3,07E-01

How to read scientific numbers:

e.g. 2,05E02 = 2,05 x 10^2 = 205

2,04E-01 = 2,04 x 10^{-1} = 0,204

Table 15: 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 (GWPF), cradle-to-grave, of the product is from 1,08E+01 (DN 15) to 1,40E01 kg CO2-eq (DN 32) for A1-C4, based on the average use phase scenario. The carbon footprint (GWPF) of production of this product, cradle-to-gate, is from 5,79E00 kg CO2-eq (DN 15) to 8,68E00 (DN32) kg CO2-eq for A1-A3.

Table 16: Resource use ABQM 4.0 DN 15 & Novocon S

	A1-A3	A4	A5	B6	C1	C2	C3.1 Recycling	C3.2 Landfill	C4.1 Recycling	C4.2 Landfill	D.1 Recycling	D.2 Landfill
PERE [MJ]	3,24E+01	7,62E-02	6,64E-03	4,75E+01	N/A	3,62E-04	1,14E-01	N/A	1,31E-02	4,06E-02	-2,11E+00	1,05E+00
PERM [MJ]	1,42E-01	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
PERT [MJ]	3,26E+01	7,62E-02	6,64E-03	4,75E+01	N/A	3,62E-04	1,14E-01	N/A	1,31E-02	4,06E-02	-2,11E+00	1,05E+00
PENRE [MJ]	8,01E+01	1,10E+00	1,61E-01	8,54E+01	N/A	1,10E-01	9,88E-01	N/A	7,03E-02	5,07E-01	-1,90E+01	-6,77E-01
PENRM [MJ]	7,81E+00	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
PENRT [MJ]	8,79E+01	1,10E+00	1,61E-01	8,54E+01	N/A	1,10E-01	9,88E-01	N/A	7,03E-02	5,07E-01	-1,90E+01	-6,77E-01
SM [kg]	4,01E-01	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
RSF [MJ]	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
NRSF [MJ]	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
FW [m3]	1,28E-01	8,81E-05	2,83E-05	4,51E-02	N/A	5,82E-07	1,21E-04	N/A	5,47E-04	3,41E-05	-4,00E-03	9,27E-04

Table 17: Resource use ABQM 4.0 DN 20 & Novocon S

	A1-A3	A4	A5	B6	C1	C2	C3.1 Recycling	C3.2 Landfill	C4.1 Recycling	C4.2 Landfill	D.1 Recycling	D.2 Landfill
PERE [MJ]	3,42E+01	9,27E-02	6,64E-03	4,75E+01	N/A	4,53E-04	1,32E-01	N/A	1,32E-02	4,70E-02	-2,16E+00	1,51E+00
PERM [MJ]	1,42E-01	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
PERT [MJ]	3,44E+01	9,27E-02	6,64E-03	4,75E+01	N/A	4,53E-04	1,32E-01	N/A	1,32E-02	4,70E-02	-2,16E+00	1,51E+00
PENRE [MJ]	8,58E+01	1,34E+00	1,61E-01	8,54E+01	N/A	1,37E-01	1,25E+00	N/A	7,09E-02	5,77E-01	-1,97E+01	-2,01E-01
PENRM [MJ]	7,84E+00	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
PENRT [MJ]	9,37E+01	1,34E+00	1,61E-01	8,54E+01	N/A	1,37E-01	1,25E+00	N/A	7,09E-02	5,77E-01	-1,97E+01	-2,01E-01
SM [kg]	5,32E-01	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
RSF [MJ]	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
NRSF [MJ]	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
FW [m3]	1,31E-01	1,07E-04	2,83E-05	4,51E-02	N/A	7,27E-07	1,42E-04	N/A	5,53E-04	4,48E-05	-4,11E-03	1,39E-03

Table 18: Resource use ABQM 4.0 DN 25 & Novocon S

	A1-A3	A4	A5	B6	C1	C2	C3.1 Recycling	C3.2 Landfill	C4.1 Recycling	C4.2 Landfill	D.1 Recycling	D.2 Landfill
PERE [MJ]	4,31E+01	1,26E-01	6,22E-03	4,75E+01	N/A	6,41E-04	1,70E-01	N/A	1,34E-02	6,15E-02	-3,08E+00	2,25E+00
PERM [MJ]	1,42E-01	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
PERT [MJ]	4,33E+01	1,26E-01	6,22E-03	4,75E+01	N/A	6,41E-04	1,70E-01	N/A	1,34E-02	6,15E-02	-3,08E+00	2,25E+00
PENRE [MJ]	1,10E+02	1,83E+00	1,51E-01	8,54E+01	N/A	1,95E-01	1,79E+00	N/A	7,19E-02	7,42E-01	-2,62E+01	6,38E-01
PENRM [MJ]	8,84E+00	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
PENRT [MJ]	1,19E+02	1,83E+00	1,51E-01	8,54E+01	N/A	1,95E-01	1,79E+00	N/A	7,19E-02	7,42E-01	-2,62E+01	6,38E-01
SM [kg]	7,55E-01	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
RSF [MJ]	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
NRSF [MJ]	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
FW [m3]	1,43E-01	1,46E-04	2,64E-05	4,51E-02	N/A	1,03E-06	1,85E-04	N/A	5,63E-04	6,64E-05	-1,01E-02	2,17E-03

Table 19: Resource use ABQM 4.0 DN 32 & Novocon S

	A1-A3	A4	A5	B6	C1	C2	C3.1 Recycling	C3.2 Landfill	C4.1 Recycling	C4.2 Landfill	D.1 Recycling	D.2 Landfill
PERE [MJ]	4,77E+01	1,63E-01	6,84E-03	4,75E+01	N/A	8,37E-04	2,09E-01	N/A	1,34E-02	7,64E-02	-3,69E+00	3,11E+00
PERM [MJ]	1,52E-01	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
PERT [MJ]	4,78E+01	1,63E-01	6,84E-03	4,75E+01	N/A	8,37E-04	2,09E-01	N/A	1,34E-02	7,64E-02	-3,69E+00	3,11E+00
PENRE [MJ]	1,24E+02	2,36E+00	1,66E-01	8,54E+01	N/A	2,54E-01	2,36E+00	N/A	7,19E-02	9,09E-01	-3,12E+01	1,49E+00
PENRM [MJ]	9,70E+00	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
PENRT [MJ]	1,34E+02	2,36E+00	1,66E-01	8,54E+01	N/A	2,54E-01	2,36E+00	N/A	7,19E-02	9,09E-01	-3,12E+01	1,49E+00
SM [kg]	1,01E+00	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
RSF [MJ]	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
NRSF [MJ]	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
FW [m3]	1,50E-01	1,88E-04	2,91E-05	4,51E-02	N/A	1,35E-06	2,31E-04	N/A	5,63E-04	8,91E-05	-1,39E-02	3,05E-03

Table 20: 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 21: Waste categories and output flows ABQM 4.0 DN 15 & Novocon S

	A1-A3	**A4**	**A5**	**B6**	**C1**	**C2**	**C3.1** Recycling	**C3.2** Landfill	**C4.1** Recycling	**C4.2** Landfill	**D.1** Recycling	**D.2** Landfill
HWD [kg]	1,10E-06	5,84E-12	6,64E-13	7,40E-09	N/A	7,57E-13	1,29E-11	N/A	5,33E-12	5,03E-11	-9,23E-06	-3,31E-09
NHWD [kg]	2,35E-01	1,80E-04	1,49E-05	6,45E-02	N/A	1,10E-05	2,17E-04	N/A	1,24E-02	8,54E-01	1,79E-02	1,86E-02
RWD [kg]	3,63E-03	2,05E-06	3,81E-07	1,36E-02	N/A	1,18E-07	1,67E-05	N/A	3,01E-06	4,86E-06	-1,99E-04	1,37E-04
CRU [kg]	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
MFR [kg]	2,55E-01	N/A	N/A	N/A	N/A	N/A	N/A	N/A	7,28E-01	N/A	N/A	N/A
MER [kg]	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
EEE [MJ]	1,04E-02	N/A	N/A	N/A	N/A	N/A	N/A	N/A	3,30E-01	N/A	N/A	N/A
EET [MJ]	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	5,98E-01	N/A	N/A	N/A

Table 22: Waste categories and output flows ABQM 4.0 DN 20 & Novocon S

	A1-A3	**A4**	**A5**	**B6**	**C1**	**C2**	**C3.1** Recycling	**C3.2** Landfill	**C4.1** Recycling	**C4.2** Landfill	**D.1** Recycling	**D.2** Landfill
HWD [kg]	1,10E-06	7,10E-12	6,64E-13	7,40E-09	N/A	9,45E-13	1,43E-11	N/A	5,37E-12	5,27E-11	-9,22E-06	-3,09E-09
NHWD [kg]	2,71E-01	2,19E-04	1,49E-05	6,45E-02	N/A	1,38E-05	2,59E-04	N/A	1,25E-02	1,07E+00	1,85E-02	2,48E-02
RWD [kg]	3,88E-03	2,49E-06	3,81E-07	1,36E-02	N/A	1,47E-07	1,72E-05	N/A	3,03E-06	5,36E-06	-2,03E-04	1,94E-04
CRU [kg]	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
MFR [kg]	3,61E-01	N/A	N/A	N/A	N/A	N/A	N/A	N/A	9,40E-01	N/A	N/A	N/A
MER [kg]	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
EEE [MJ]	1,05E-02	N/A	N/A	N/A	N/A	N/A	N/A	N/A	3,34E-01	N/A	N/A	N/A
EET [MJ]	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	6,05E-01	N/A	N/A	N/A

Table 23: Waste categories and output flows ABQM 4.0 DN 25 & Novocon S

	A1-A3	A4	A5	B6	C1	C2	C3.1 Recycling	C3.2 Landfill	C4.1 Recycling	C4.2 Landfill	D.1 Recycling	D.2 Landfill
HWD [kg]	1,11E-06	9,69E-12	6,22E-13	7,40E-09	N/A	1,34E-12	1,72E-11	N/A	5,44E-12	6,11E-11	-4,74E-05	-3,13E-09
NHWD [kg]	3,74E-01	2,99E-04	1,40E-05	6,45E-02	N/A	1,95E-05	3,48E-04	N/A	1,27E-02	1,51E+00	2,70E-02	3,65E-02
RWD [kg]	5,89E-03	3,40E-06	3,57E-07	1,36E-02	N/A	2,08E-07	1,82E-05	N/A	3,08E-06	6,64E-06	-2,36E-04	2,88E-04
CRU [kg]	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
MFR [kg]	5,42E-01	N/A	N/A	N/A	N/A	N/A	N/A	N/A	1,38E+00	N/A	N/A	N/A
MER [kg]	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
EEE [MJ]	1,06E-02	N/A	N/A	N/A	N/A	N/A	N/A	N/A	3,42E-01	N/A	N/A	N/A
EET [MJ]	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	6,19E-01	N/A	N/A	N/A

Table 24: Waste categories and output flows ABQM 4.0 DN 32 & Novocon S

	A1-A3	A4	A5	B6	C1	C2	C3.1 Recycling	C3.2 Landfill	C4.1 Recycling	C4.2 Landfill	D.1 Recycling	D.2 Landfill
HWD [kg]	1,13E-06	1,25E-11	6,84E-13	7,40E-09	N/A	1,75E-12	2,02E-11	N/A	5,44E-12	6,92E-11	-7,10E-05	-3,16E-09
NHWD [kg]	4,65E-01	3,85E-04	1,54E-05	6,45E-02	N/A	2,54E-05	4,41E-04	N/A	1,27E-02	1,98E+00	3,37E-02	4,92E-02
RWD [kg]	6,51E-03	4,39E-06	3,92E-07	1,36E-02	N/A	2,72E-07	1,93E-05	N/A	3,08E-06	7,93E-06	-2,56E-04	3,95E-04
CRU [kg]	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
MFR [kg]	7,45E-01	N/A	N/A	N/A	N/A	N/A	N/A	N/A	1,85E+00	N/A	N/A	N/A
MER [kg]	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
EEE [MJ]	1,06E-02	N/A	N/A	N/A	N/A	N/A	N/A	N/A	3,42E-01	N/A	N/A	N/A
EET [MJ]	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	6,19E-01	N/A	N/A	N/A

Table 25: 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 26: Additional indicators* ABQM 4.0 DN 15 & Novocon S

	A1-A3	A4	A5	B6	C1	C2	C3.1 Recycling	C3.2 Landfill	C4.1 Recycling	C4.2 Landfill	D.1 Recycling	D.2 Landfill
PM [Disease incidences]	2,82E-07	9,57E-10	3,72E-10	8,56E-08	N/A	6,14E-11	2,54E-09	N/A	3,68E-10	1,59E-09	-2,96E-08	2,39E-08
IRP [kBq U235 eq.]	4,85E-01	3,10E-04	3,23E-05	2,31E+00	N/A	1,67E-05	2,80E-03	N/A	4,78E-04	6,71E-04	-1,73E-02	5,91E-03
ETPfw [CTUe]	6,89E+01	7,80E-01	1,21E-01	3,74E+01	N/A	7,97E-02	6,72E-01	N/A	4,56E-02	2,18E+00	-2,33E+01	1,08E+00
HTPc [CTUh]	3,31E-08	1,61E-11	1,94E-12	1,08E-09	N/A	1,48E-12	1,42E-11	N/A	3,16E-12	2,36E-11	-1,49E-09	9,90E-11
HTPnc [CTUh]	1,48E-07	8,96E-10	8,06E-11	3,93E-08	N/A	6,42E-11	8,44E-10	N/A	1,81E-10	2,20E-09	-1,80E-08	1,44E-08
SQP [Pt]	5,03E+01	4,66E-01	3,40E-02	3,09E+01	N/A	2,81E-04	4,11E-01	N/A	1,57E-02	4,41E-02	-1,83E+00	2,13E+00

Table 27: Additional indicators* ABQM 4.0 DN 20 & Novocon S

	A1-A3	A4	A5	B6	C1	C2	C3.1 Recycling	C3.2 Landfill	C4.1 Recycling	C4.2 Landfill	D.1 Recycling	D.2 Landfill
PM [Disease incidences]	3,04E-07	1,16E-09	3,72E-10	8,56E-08	N/A	7,67E-11	3,26E-09	N/A	3,71E-10	1,94E-09	-3,10E-08	3,41E-08
IRP [kBq U235 eq.]	5,16E-01	3,76E-04	3,23E-05	2,31E+00	N/A	2,08E-05	2,87E-03	N/A	4,82E-04	7,28E-04	-1,72E-02	8,14E-03
ETPfw [CTUe]	7,24E+01	9,48E-01	1,21E-01	3,74E+01	N/A	9,95E-02	8,55E-01	N/A	4,60E-02	2,96E+00	-2,38E+01	2,16E+00
HTPc [CTUh]	3,33E-08	1,95E-11	1,94E-12	1,08E-09	N/A	1,85E-12	1,80E-11	N/A	3,18E-12	2,75E-11	-1,50E-09	1,45E-10
HTPnc [CTUh]	1,60E-07	1,09E-09	8,06E-11	3,93E-08	N/A	8,02E-11	1,08E-09	N/A	1,81E-10	2,61E-09	-1,91E-08	2,08E-08
SQP [Pt]	5,33E+01	5,66E-01	3,40E-02	3,09E+01	N/A	3,51E-04	5,20E-01	N/A	1,58E-02	5,28E-02	-1,93E+00	3,04E+00

Table 28: Additional indicators* ABQM 4.0 DN 25 & Novocon S

	A1-A3	A4	A5	B6	C1	C2	C3.1 Recycling	C3.2 Landfill	C4.1 Recycling	C4.2 Landfill	D.1 Recycling	D.2 Landfill
PM [Disease incidences]	3,84E-07	1,59E-09	3,48E-10	8,56E-08	N/A	1,09E-10	4,75E-09	N/A	3,76E-10	2,67E-09	-7,77E-08	5,27E-08
IRP [kBq U235 eq.]	8,32E-01	5,14E-04	3,02E-05	2,31E+00	N/A	2,95E-05	3,03E-03	N/A	4,89E-04	8,84E-04	-1,89E-02	1,17E-02
ETPfw [CTUe]	8,47E+01	1,29E+00	1,13E-01	3,74E+01	N/A	1,41E-01	1,24E+00	N/A	4,66E-02	4,32E+00	-2,78E+01	3,91E+00
HTPc [CTUh]	1,77E-07	2,67E-11	1,81E-12	1,08E-09	N/A	2,62E-12	2,60E-11	N/A	3,21E-12	3,64E-11	-6,57E-09	2,81E-10
HTPnc [CTUh]	1,90E-07	1,49E-09	7,54E-11	3,93E-08	N/A	1,14E-10	1,57E-09	N/A	1,83E-10	3,52E-09	-2,41E-08	3,19E-08
SQP [Pt]	6,19E+01	7,73E-01	3,18E-02	3,09E+01	N/A	4,98E-04	7,51E-01	N/A	1,60E-02	7,19E-02	-2,72E+00	4,57E+00

Table 29: Additional indicators* ABQM 4.0 DN 32 & Novocon S

	A1-A3	A4	A5	B6	C1	C2	C3.1 Recycling	C3.2 Landfill	C4.1 Recycling	C4.2 Landfill	D.1 Recycling	D.2 Landfill
PM [Disease incidences]	4,47E-07	2,05E-09	3,82E-10	8,56E-08	N/A	1,42E-10	6,31E-09	N/A	3,76E-10	3,43E-09	-1,08E-07	7,28E-08
IRP [kBq U235 eq.]	9,10E-01	6,62E-04	3,33E-05	2,31E+00	N/A	3,86E-05	3,19E-03	N/A	4,89E-04	1,04E-03	-1,90E-02	1,59E-02
ETPfw [CTUe]	9,32E+01	1,67E+00	1,25E-01	3,74E+01	N/A	1,84E-01	1,64E+00	N/A	4,66E-02	5,83E+00	-3,09E+01	5,87E+00
HTPc [CTUh]	2,66E-07	3,44E-11	2,00E-12	1,08E-09	N/A	3,42E-12	3,43E-11	N/A	3,21E-12	4,55E-11	-9,72E-09	4,03E-10
HTPnc [CTUh]	2,17E-07	1,92E-09	8,30E-11	3,93E-08	N/A	1,48E-10	2,07E-09	N/A	1,83E-10	4,46E-09	-2,83E-08	4,42E-08
SQP [Pt]	6,91E+01	9,96E-01	3,50E-02	3,09E+01	N/A	6,50E-04	9,90E-01	N/A	1,60E-02	9,16E-02	-3,29E+00	6,28E+00

Table 30: 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.

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