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The Norwegian EPD Foundation

ENVIRONMENTAL PRODUCT DECLARATION

in accordance with ISO 14025

Owner of the declaration:	Borregaard AS
Program operator:	The Norwegian EPD Foundation
Publisher:	The Norwegian EPD Foundation
Declaration number:	NEPD-2973-1657-EN
Issue date:	10.08.2021
Valid to:	10.08.2026

Bioethanol

Borregaard AS

Borregaard

www.epd-norge.no

General information

Product

Bioethanol

Owner of the declaration

Borregaard AS

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Manufacturer

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Declaration number

NEPD-2973-1657-EN

Place of production:

Sarpsborg, Norway

This declaration is based on Product Category Rules:

Basic organic chemicals 2011:17 v. 2.11 (Environdec 2019)

Management system:

ISO 9001 (Quality Management), ISO 14001 (Environmental Management) and ISO 50001 (Energy Management)

Statements:

The owner of the declaration shall be liable for the underlying information and evidence.
EPD Norway shall not be liable with respect to manufacturer, life cycle assessment data and evidences.

Organisation no:

895623032

Issue date

10.08.2021

Valid to

10.08.2026

Declared unit:

The declared unit is 1000 kg DM of bioethanol.

Year of study:

2019

Declared unit with option:

1000 kg DM of bioethanol with transport to customers.

Comparability:

EPDs from other programmes than the Norwegian EPD Foundation may not be comparable.

Functional unit:

The EPD has been worked out by:

Ellen Soldal Ingunn Saur Modahl

NORSUS
Norsk institutt for bærekraftsforskning

Verification:

Independent verification of the declaration and data, according to ISO14025:2010

☐ internal ☒ external

Third party verifier:

Mie Vold, CSO, LCA.no AS
(Independent verifier approved by EPD Norway)

Approved

Håkon Hauan
Managing Director of EPD-Norway

Product

Product description:

Bioethanol from Borregaard is a diverse product suited for many different applications. End product can range from biofuel, disinfectants, pharmaceutical and cosmetic products. Borregaards bioethanol has a high degree of purity and is based on wood, a natural and renewable raw material.

Technical data:

Dry matter (DM) content: 99%

Product specification

Materials*	kg	%
Bioethanol	999 kg	99,9 %
Water	1 kg	0,1 %

*Here the product content is given on wet basis as sold to customer. However, the data and results in this EPD are given per ton dry matter (DM).

Market:

Global

Reference service life:

Not relevant

LCA: Calculation rules

Declared unit:

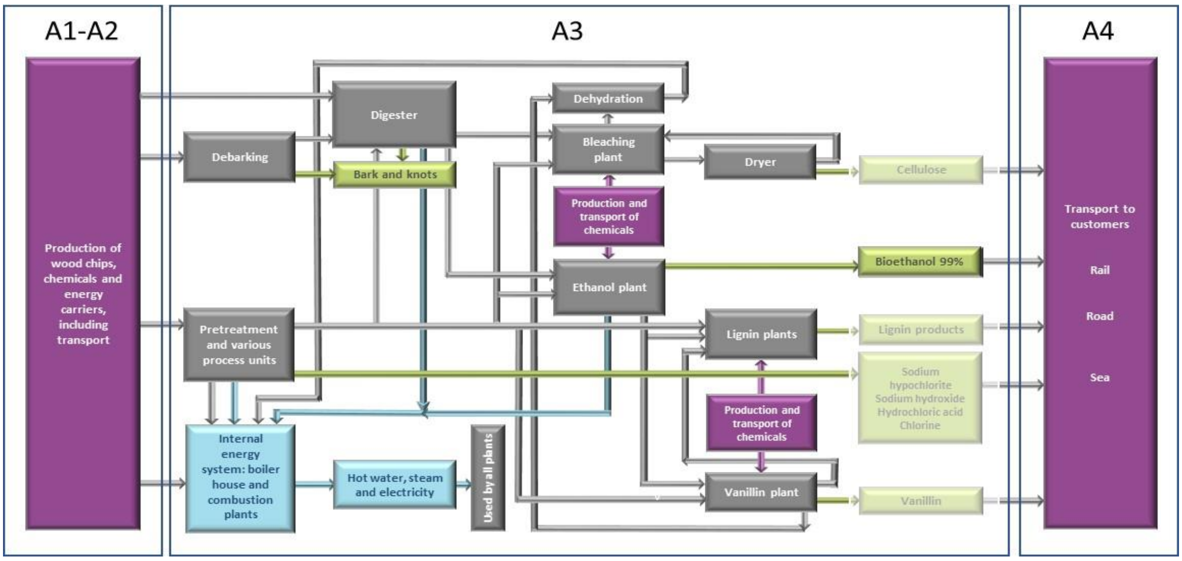
The declared unit is 1000 kg DM of anhydrous bioethanol, including 1000 km of transport to customer (A4). Transportation to customer has been corrected to account for the burden of transporting water.

System boundary:

The system boundary includes the modules A1-A4, illustrated by the flowchart. A1-A4 includes extraction, transportation and processing of natural resources, manufacturing of the product and transportation of the product 1000 km by typical transportation modes.

Further description of system boundaries are described in Soldal & Modahl (2021) and Modahl & Soldal (2021).

Figure 1: Technical flow chart illustrating the life cycle stages included in the EPD.



Data quality:

Data on consumption of natural resources, energy carriers, and chemicals, and transport modes are site specific from Borregaard Sarpsborg in Norway. Foreground data refer to the year 2019. For the background data, representative data from ecoinvent version 3.6, dated September 2019, is used (Wernet et al. 2016).

The energy mix used in steam production is averaged over seven years (2014-2020). This was done because the input of electricity

Cut-off criteria:

All major raw materials and all the essential energy is included. This cut-off rule does not apply for hazardous materials and substances.

and natural gas fluctuates between years depending on price. To get a representative annual value for energy in steam production, the input of electricity and natural gas was averaged over the 7-year period. In this period, the average share of electricity input in the steam boiler was 63%, while the average share of natural gas was 37%.

Allocation:
The allocation is made in accordance with the provisions of ISO 14025. Allocation has as far as possible, been avoided by modelling the processes at Borregaard on a detailed level. When allocation has been necessary, allocation based on mass (DM) has been used. In processes with hot water as an outflow and where the hot water is exploited in other processes, the energy content has been calculated into mass through use of the heat value for biological dry matter.

Deviations from the PCR:
This EPD deviates from the PCR regarding inclusion of energy used in office space. All energy consumption has been collected and reported collectively. The energy used in office spaces are assumed to be negligible compared to the energy used in production processes.
The declared unit is 1000 kg DM without packaging.

LCA: Scenarios and additional technical information

The following information describe the scenarios in the different modules of the EPD.

Production takes place in Sarpsborg, Norway, and transport to customers is included. Transport from production place to customer is based on information from Borregaard regarding typical transport distance and transport modes.

Anhydrous bioethanol is transported 1000 km. Anhydrous bioethanol is transported on sea (10%), rail (85%) and road (5%). Transport distances have been corrected in order to include transport of water.

No scenario after A4 is included.

Transport from production place to assembly/user (A4)

Type	Capacity utilisation (incl. return) %	Type of vehicle	Distance km	Fuel/Energy consumption		Value (l/t)
Truck	55%*	Lorry, 16-32 metric ton, EURO5	50	0,032	l/tkm	1,60E+00
Railway	50%*	Freight train (electric and diesel)	34	5,78E-04	l/tkm	1,97E-02
			817	8,61E-02	kWh/tkm	7,03E+01
Boat	70%*	Container ship	100	2,00E-03	l/tkm	2,00E-01

*For the transport processes, average data from ecoinvent 3.6 is used and it is assumed the same average capasity load here.

LCA: Results

A1-A3 are the most influential life cycle stages in all impact categories compared to A4. A1-A3 contributes to between 93% and >99% of the total impacts. For climate change impact category, A1-A3 is responsible for 96% of the impacts of A1-A4 combined. Steam and wood raw materials are important for the climate change impact of bioethanol. Direct emissions from the production is important in the impact category EP.

System boundaries (X=included, MND=module not declared, MNR=module not relevant)

Product stage			Assembly stage		Use stage							End of life stage				Beyond the system boundaries
Raw materials	Transport	Manufacturing	Transport	Assembly	Use	Maintenance	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	De-construction demolition	Transport	Waste processing	Disposal	Reuse-Recovery-Recycling-potential
A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
X	X	X	X	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND

Environmental impact

Parameter	Unit	A1-A3	A4	A1-A4
GWP	kg CO_2-eqv	2,41E+02	1,12E+01	2,52E+02
ODP	kg CFC11-eqv	3,83E-05	2,79E-06	4,11E-05
POCP	kg C_2H_4-eqv	1,05E-01	2,07E-03	1,07E-01
AP	kg SO_2-eqv	2,14E+00	7,29E-02	2,21E+00
EP	kg PO_4^{3-}-eqv	6,44E-01	1,33E-02	6,57E-01
ADPM	kg Sb-eqv	1,70E-03	1,96E-06	1,71E-03
ADPE	MJ	2,89E+03	1,53E+02	3,05E+03

GWP Global warming potential; ODP Depletion potential of the stratospheric ozone layer; POCP Formation potential of tropospheric photochemical oxidants; AP Acidification potential of land and water; EP Eutrophication potential; ADPM Abiotic depletion potential for non fossil resources; ADPE Abiotic depletion potential for fossil resources

Resource use				
Parameter	**Unit**	**A1-A3**	**A4**	**A1-A4**
RPEE	MJ	4,75E+03	2,55E+02	5,00E+03
RPEM	MJ	1,91E+04	0,00E+00	1,91E+04
TPE	MJ	2,41E+04	2,55E+02	2,44E+04
NRPE	MJ	3,23E+03	2,61E+02	3,49E+03
NRPM	MJ	0,00E+00	0,00E+00	0,00E+00
TRPE	MJ	3,23E+03	2,61E+02	3,49E+03
SM	kg	0,00E+00	0,00E+00	0,00E+00
RSF	MJ	0,00E+00	0,00E+00	0,00E+00
NRSF	MJ	0,00E+00	0,00E+00	0,00E+00
W	m^3	3,44E+01	9,25E-01	3,53E+01

RPEE Renewable primary energy resources used as energy carrier; RPEM Renewable primary energy resources used as raw materials; TPE Total use of renewable primary energy resources; NRPE Non renewable primary energy resources used as energy carrier; NRPM Non renewable primary energy resources used as materials; TRPE Total use of non renewable primary energy resources; SM Use of secondary materials; RSF Use of renewable secondary fuels; NRSF Use of non renewable secondary fuels; W Use of net fresh water

End of life - Waste				
Parameter	**Unit**	**A1-A3**	**A4**	**A1-A4**
HW	kg	2,76E-02	2,83E-04	2,78E-02
NHW	kg	1,02E+02	1,81E-01	1,02E+02
RW	kg	1,25E-02	2,67E-03	1,51E-02

HW Hazardous waste disposed; NHW Non hazardous waste disposed; RW Radioactive waste disposed

End of life - Output flow				
Parameter	**Unit**	**A1-A3**	**A4**	**A1-A4**
CR	kg	0,00E+00	0,00E+00	0,00E+00
MR	kg	3,69E-02	0,00E+00	3,69E-02
MER	kg	6,61E+00	0,00E+00	6,61E+00
EEE	MJ	0,00E+00	0,00E+00	0,00E+00
ETE	MJ	0,00E+00	0,00E+00	0,00E+00

CR Components for reuse; MR Materials for recycling; MER Materials for energy recovery; EEE Exported electric energy; ETE Exported thermal energy

Reading example: 9.0 E-03 = 9.0*10-3 = 0.009

Additional environmental information

Borregaard uses Norway spruce harvested in Norway (approx. 78%), Sweden (approx. 20%) and Germany (approx. 2%). All timber purchased is harvested according to the country of origin regulations of harvest, forest management and biological diversity (PEFC Chain of custody certificate SA-PEFC/COC-006557, FSC Chain of custody certificate SA-COC-006557). All timber harvested in Norway is certified according to the PEFC standard.

Additional Norwegian requirements

Greenhous gas emission from the use of electricity in the manufacturing phase

National production mix from import, low voltage (production of transmission lines, in addition to direct emissions and losses in grid) of applied electricity for the manufacturing prosess (A3).

Data source	Amount	Unit
Econinvent v3.6 (September 2019)	23,3	g CO_2-eqv/kWh

Dangerous substances

- ☐ The product contains no substances given by the REACH Candidate list or the Norwegian priority list
- ☐ The product contains substances given by the REACH Candidate list or the Norwegian priority list that are less than 0,1 % by weight.
- ☐ The product contain dangerous substances, more then 0,1% by weight, given by the REACH Candidate List or the Norwegian Priority list, see table.
- ☒ The product contains no substances given by the REACH Candidate list or the Norwegian priority list. The product is classified as hazardous waste (Avfallsforskiften, Annex III), see table.

Name	CAS no.	Amount
Ethanol	64-17-5	100 %

Indoor environment

No tests have been carried out on the product concerning indoor climate.

Bibliography

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Wernet, G., et al., 2016	*The ecoinvent database version 3 (part I): overview and methodology. The International Journal of Life Cycle Assessment 21(9): 1218-1230.*

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