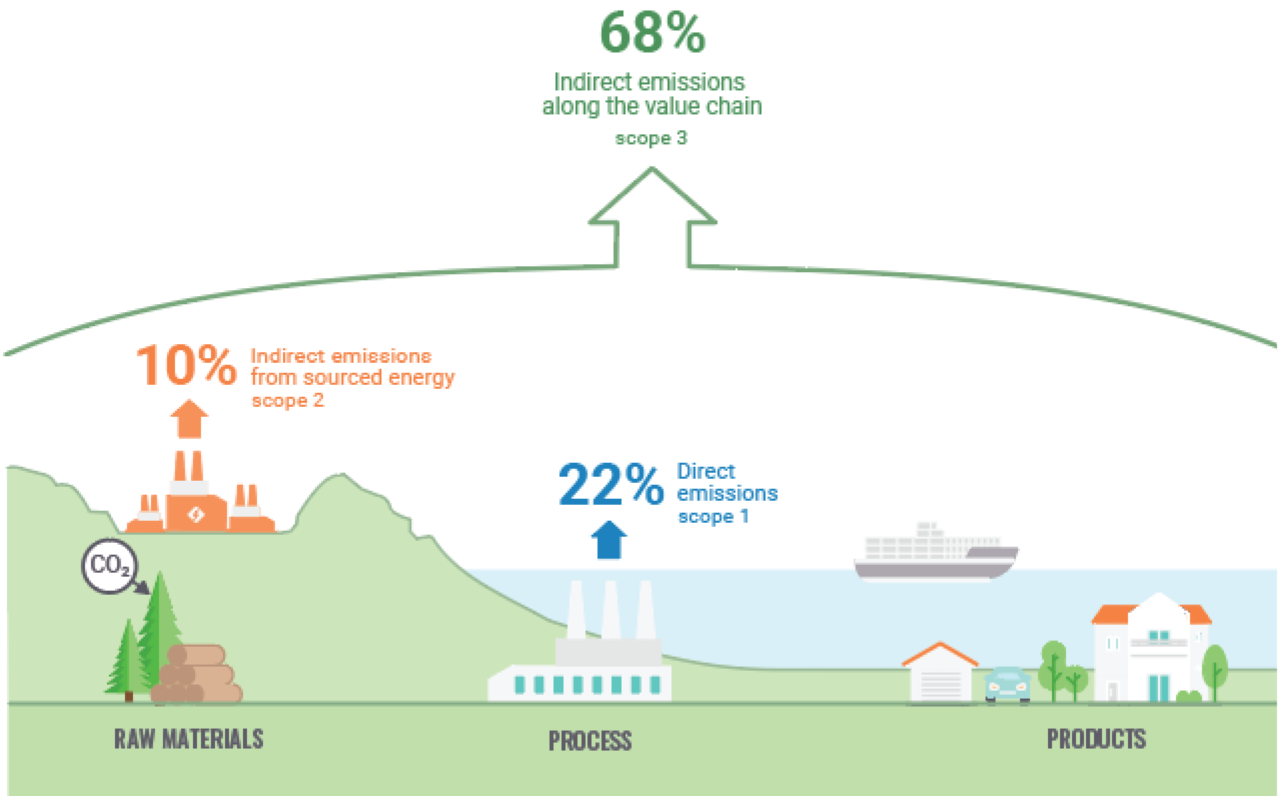
GHG protocol Scope 3 reporting - Borregaard Group 2023



AUTHOR
MAFALDA SILVA AND ANDREAS BREKKE

REPORT NO.
OR.04.24

YEAR
2024

ISBN NO.	ISSN NO.	REPORT TYPE	CONFIDENTIALITY
978-82-7520-932-8	2703-8610	Commissioned	Open

PROJECT TITLE

Borregaard GHG reporting in 2024 for 2023

PROJECT NUMBER

3474

COMMISSIONED BY

Borregaard Group

REFERENCE

4500742419

INTERNAL QUALITY CONTROL

Ingunn Saur Modahl

NUMBER OF PAGES

25

KEY WORDS

GHG protocol, Scope 3, biorefinery, GHG emissions

PHOTO FRONTPAGE

Borregaard

Sample Scope 3 GHG Inventory Reporting

This greenhouse gas reporting has been calculated in alignment with the GHG Protocol Corporate Value Chain (Scope 3) Accounting and Reporting Standard

Part 1: Descriptive information

Descriptive information	Company response
Company name	Borregaard Group
Description of the company	Borregaard is a biorefinery that produces advanced biochemicals that can replace oil-based products. Borregaard employs 1 127 man-years in plants and sales offices in 13 countries throughout Europe, Asia and the Americas.
Chosen consolidation approach (equity share, operational control or financial control)	Operational control
Description of the businesses and operations included in the company's organizational boundary	Borregaard's sales offices and Borregaard's plants in Norway, USA, Germany, the Czech Republic and UK.
The reporting period covered	01/01/2023 -12/31/2023
A list of scope 3 activities included in the report	Category 1: Purchased goods & services; Category 2: Capital goods; Category 3: Fuel- and energy-related activities (not incl. in Scope 1 or 2); Category 4: Upstream transportation and distribution; Category 5: Waste generated in operations; Category 6: Business travel; Category 7: Employee commuting; Category 9: Downstream transportation and distribution; Category 10: Processing of sold products; Category 11: Use of sold products; Category 12: End-of-life treatment of sold products; Category 15 (Operation of investments)
A list of scope 1, scope 2, and scope 3 activities excluded from the report with justification for their exclusion	Category 8 (Upstream leased assets); Category 13 (Downstream leased assets); and Category 14 (Franchises) are excluded

	because they are not relevant to Borregaard.
The year chosen as base year and rationale for choosing the base year	2020. The base year has been changed to be in line with the base year for Borregaard's science based targets.
Once a base year has been established, the chosen base year emissions recalculation policy. If base year emissions have been recalculated, the context for any significant emissions changes that triggered the recalculation.	

Part 2: Greenhouse gas emissions data

Scopes and categories	Metric tons CO_2e
Scope 1: Direct emissions from owned/controlled operations	132 772
Scope 2: Indirect emissions from the use of purchased electricity, steam, heating, and cooling	64 093
Scope 3: Other indirect GHG emissions (upstream and downstream)	410 791
Upstream scope 3 emissions	**267 317**
Category 1: Purchased goods and services	173 712
Category 2: Capital goods	19 900
Category 3: Fuel- and energy-related activities (not included in scope 1 or scope 2)	10 818
Category 4: Upstream transportation and distribution	58 864
Category 5: Waste generated in operations	1 915
Category 6: Business travel	1 140
Category 7: Employee commuting	968
Category 8: Upstream leased assets	-
Downstream scope 3 emissions	**143 474**
Category 9: Downstream transportation and distribution	30 522
Category 10: Processing of sold products	105 264
Category 11: Use of sold products	0
Category 12: End-of-life treatment of sold products	7 687
Category 13: Downstream leased assets	-
Category 14: Franchises	-
Category 15: Investments	2

Part 3: Biogenic CO_2 emissions data

Scopes and categories	Metric tons biogenic CO_2
Scope 1: Direct biogenic CO_2 emissions from owned/controlled operations	129 507
Scope 2: Indirect biogenic CO_2 emissions from the use of purchased electricity, steam, heating, and cooling	69 926
Scope 3: Other indirect GHG emissions (upstream and downstream)	983 272
Indirect biogenic CO2 emissions – Upstream	**143 602**
Category 1: Purchased goods and services	136 451
Category 2: Capital goods	1 373
Category 3: Fuel- and energy-related activities (not included in scope 1 or scope 2)	2 138
Category 4: Upstream transportation and distribution	318
Category 5: Waste generated in operations	3 253
Category 6: Business travel	8.5
Category 7: Employee commuting	60
Category 8: Upstream leased assets	-
Indirect biogenic CO2 emissions - Downstream	**839 670**
Category 9: Downstream transportation and distribution	199
Category 10: Processing of sold products	16 684
Category 11: Use of sold products	112 387
Category 12: End-of-life treatment of sold products	710 400
Category 13: Downstream leased assets	-
Category 14: Franchises	-
Category 15: Investments	0.5

Part 4: Description of methodologies and data used

Scope and category	Description of the types and sources of data used to calculate emissions	Description of the data quality of reported emissions	Description of the methodologies, allocation methods, and assumptions used to calculate emissions	Percentage of emissions calculated using data obtained from suppliers or other value chain partners
Upstream scope 3 emissions				
Category 1: Purchased goods and services	Activity data (primary data) obtained from Borregaard and several suppliers. Secondary data obtained as cradle-to-gate emissions factors from the commercially and publicly available database ecoinvent ver. 3.9 (Wernet et al. 2016). For 16 of the chemicals, carbon footprint has been obtained from the supplier.	Good	Hybrid method. For characterization of the GHG emissions and emissions of biogenic CO_2, the IPCC 2021 GWP100a (incl. CO_2 uptake), v.1.0, as implemented in SimaPro v. 9.5 has been used.	40%
Category 2: Capital goods	Activity data (primary data) obtained from Borregaard. Secondary data obtained as cradle-to-gate emissions	Fair	Hybrid method. For characterization of the GHG emissions and emissions of biogenic CO_2, the IPCC 2021	0%

	factors from the commercially and publicly available database ecoinvent ver. 3.9 (Wernet et al., 2016).		GWP100a (incl. CO_2 uptake), v.1.0, as implemented in SimaPro v. 9.5 has been used.	
Category 3: Fuel- and energy-related activities (not included in scope 1 or scope 2)	Activity data (primary data) obtained from Borregaard. Secondary data for fuels obtained as cradle-to-gate emissions factors, not included in Scope 1 and 2, from the commercially and publicly available database ecoinvent ver. 3.9 (Wernet et al. 2016).	Good	Hybrid method. For characterization of the GHG emissions and emissions of biogenic CO_2, the IPCC 2021 GWP100a (incl. CO_2 uptake), v.1.0, as implemented in SimaPro v. 9.5 has been used.	0%
Category 4: Upstream transportation and distribution	Activity data, transport mode and distances (primary data) obtained from Borregaard. Secondary data (emissions factors) obtained from the commercially and publicly available database ecoinvent ver. 3.9 (Wernet et al. 2016).	Good	Hybrid method. Assume that road transport is performed by lorry Euro V. This class is the most dominant in Norway (2016). For characterization of the GHG emissions and emissions of biogenic CO_2, the IPCC 2021 GWP100a (incl. CO_2 uptake), v.1.0, as	0%

			implemented in SimaPro v. 9.5 has been used.	
Category 5: Waste generated in operations	Activity data (primary data) obtained from Borregaard. Secondary data obtained from the commercially and publicly available database ecoinvent ver. 3.9 (Wernet et al. 2016).	Good	Hybrid method. For characterization of the GHG emissions and emissions of biogenic CO_2, the IPCC 2021 GWP100a (incl. CO_2 uptake), v.1.0, as implemented in SimaPro v. 9.5 has been used.	0%
Category 6: Business travel	Borregaard France, has provided CO_2-emissions due to air, road and train travels. Otherwise, activity data (hotel nights and km travelled by each mode of transport) is obtained from Borregaard. For these activities, emissions factors are obtained from the commercially and publicly available database ecoinvent ver. 3.9 (Wernet et al. 2016).	Good	For characterization of the GHG emissions and emissions of biogenic CO_2, the IPCC 2021 GWP100a (incl. CO_2 uptake), v.1.0, as implemented in SimaPro v. 9.5 has been used.	29%
Category 7: Employee commuting	Number of employees and postal	Good	Combination of distance from home of	0%

	address obtained from Borregaard. National statistic on work travel habits assumed to be relevant for Borregaard Norway (Epiniom 2019). Emissions factors for commuting by car, is based on the average Norwegian passenger car in 2021 (SSB, 2021). Emissions factors (secondary data) obtained from the commercially and publicly available database ecoinvent ver. 3.9 (Wernet et al. 2016).		employees to Borregaard Sarpsborg and national statics on work travel habits, were the basis for calculation of person km (pkm) travelled by different modes of transport: on feet (0 g CO_2-eq/pkm), bike (0 g CO_2-eq/pkm), car (186 g CO_2-eq/pkm), bus (102 g CO_2-eq/pkm), and train (3 g CO_2-eq/pkm). For characterization of the GHG emissions and emissions of biogenic CO_2, the IPCC 2021 GWP100a (incl. CO_2 uptake), v.1.0, as implemented in SimaPro v. 9.5 has been used.	
Category 8: Upstream leased assets	-	-	-	-

Part 4: Description of scope 3 methodologies and data used (continued)

Scope and category	Description of the types and sources of data used to calculate emissions	Description of the data quality of reported emissions	Description of the methodologies, allocation methods, and assumptions used to calculate emissions	Percentage of emissions calculated using data obtained from suppliers or other value chain partners
Downstream scope 3 emissions				
Category 9: Downstream transportation and distribution	Specific transport volumes and modes of transport given by Borregaard. Emissions factors (secondary data) obtained from the commercially and publicly available database ecoinvent ver. 3.9 (Wernet et al. 2016).	Good	Hybrid method. For characterization of the GHG emissions and emissions of biogenic CO_2, the IPCC 2021 GWP100a (incl. CO_2 uptake), v.1.0, as implemented in SimaPro v. 9.5 has been used.	0%
Category 10: Processing of sold products	Data on amount of sold products obtained from Borregaard. Emissions factors (secondary data) obtained from the commercially and publicly available database ecoinvent ver. 3.9 (Wernet et al. 2016).	Good	For several of the products, there is no processing, or the processing is marginal. The two largest products are cellulose and lignin. Lignin is mostly used in construction, and energy consumed during mixing with cement is used. For cellulose, it is assumed that the sold cellulose	73%

			goes to the following application areas: - Nitrocellulose production; - Viscose (casings) production; - Ether production; - Acetate production. For characterization of the GHG emissions and emissions of biogenic CO_2, the IPCC 2021 GWP100a (incl. CO_2 uptake), v.1.0, as implemented in SimaPro v. 9.5 has been used.	
Category 11: Use of sold products	Data on amounts of sold products and carbon content obtained from Borregaard.	Good	There are no direct emissions in the use phase of all products except ethanol, alvamix, twigs and bark which are combusted and lead to emissions of biogenic CO_2. The amount of biogenic CO_2 is calculated based on carbon content of the products multiplied with the molecular weight ratio carbon to CO_2.	100%
Category 12: End-of-life treatment of sold products	Specific information on carbon content and amount of sold products obtained from	Good	Hybrid. Due to biological origin, the sold products are assumed to not cause	99% of biogenic CO_2 emissions, 0% of fossil emissions

	Borregaard. Sodium hypochlorite and hydrochloric acid are treated as hazardous waste at end of life. Data on the amount of sodium hypochlorite and hydrochloric acid are given by Borregaard. Emissions factors (secondary data) obtained from the commercially and publicly available database ecoinvent ver. 3.9 (Wernet et al. 2016).		emissions of GHG in end-of-life treatment. Emissions of biogenic CO_2 from end-of-life treatment calculated based on carbon content of sold products multiplied with the molecular weight ratio carbon to CO_2. For characterization of the GHG emissions and emissions of biogenic CO_2, the IPCC 2021 GWP100a (incl. CO_2 uptake), v.1.0, as implemented in SimaPro v. 9.5 has been used.	
Category 13: Downstream leased assets	-	-	-	-
Category 14: Franchises	-	-	-	-
Category 15: Investments	Specific information electricity consumption obtained from Borregaard. Emissions factors (secondary data) obtained from the commercially and publicly available database ecoinvent ver. 3.9 (Wernet et al. 2016).	Good	For characterization of the GHG emissions and emissions of biogenic CO_2, the IPCC 2021 GWP100a (incl. CO_2 uptake), v.1.0, as implemented in SimaPro v. 9.5 has been used.	0%

Norwegian Institute for Sustainability Research

Part 5: Greenhouse gas emissions in the base year

Please state your base year emissions here. If base year emissions were recalculated, note the year the recalculation occurred.

The base year is 2020 and the greenhouse gas emissions are given in the Table below.

Scopes and categories[1]	Metric tons CO_2e
Scope 1: Direct emissions from owned/controlled operations	130 945
Scope 2: Indirect emissions from the use of purchased electricity, steam, heating, and cooling	65 414
Scope 3: Other indirect GHG emissions (upstream and downstream)	399 998
Upstream scope 3 emissions	**153 128**
Category 1: Purchased goods and services	123 178
Category 2: Capital goods	2 142
Category 3: Fuel- and energy-related activities (not included in scope 1 or scope 2)	10 331
Category 4: Upstream transportation and distribution	13 721
Category 5: Waste generated in operations	2 037
Category 6: Business travel	588
Category 7: Employee commuting	1 131
Category 8: Upstream leased assets	-
Other	-
Downstream scope 3 emissions	**246 870**
Category 9: Downstream transportation and distribution	165 330
Category 10: Processing of sold products	56 638
Category 11: Use of sold products	0
Category 12: End-of-life treatment of sold products	7 482
Category 13: Downstream leased assets	-
Category 14: Franchises	-
Category 15: Investments[2]	17 420
Other	-

[1] Further disaggregation of certain categories may be necessary. Additionally, if categorization of scope 3 activities is not followed as prescribed in the standard, indicate where they are included.

[2] If the reporting company is an initial sponsor or lender of a project, also account for the projected lifetime emissions of relevant projects financed during the reporting year and report those emissions separately from scope 3.

Part 6: Optional Information

Method

Name IPCC 2021 GWP100a (incl. CO_2 uptake), v.1.0

Table 1 and 2 give the characterization factors used in this reporting, fossil and biogenic CO_2 respectively.

Table 1 Characterization factors for substances contributing to emissions of fossil CO_2-equivalents. The unit is kg CO_2-eq./kg substance.

Substances	Characterization factor	Unit
(E)-1,1,1,4,4,4-Hexafluorobut-2-ene	17.9	kg CO_2-eq./kg
(E)-1,2,3,3,3-Pentafluoroprop-1-ene	0.118	kg CO_2-eq./kg
(E)-1,2-Dichlorohexafluorocyclobutane	4230	kg CO_2-eq./kg
(E)-1-Chloro-3,3,3-trifluoroprop-1-ene	3.88	kg CO_2-eq./kg
(E)-Hex-2-en-1-ol	0.002	kg CO_2-eq./kg
(E/Z)-1-chloro-2-fluoro-ethene	0.004	kg CO_2-eq./kg
(Perfluorobutyl)ethylene	0.204	kg CO_2-eq./kg
(Perfluoroctyl)ethylene	0.141	kg CO_2-eq./kg
(Perfluorohexyl)ethylene	0.162	kg CO_2-eq./kg
(Z)-1,1,1,4,4,4-Hexafluorobut-2-ene	2.08	kg CO_2-eq./kg
(Z)-1,2,3,3,3-Pentafluoroprop-1-ene	0.344	kg CO_2-eq./kg
(Z)-1,2-Dichlorohexafluorocyclobutane	5660	kg CO_2-eq./kg
(Z)-1,3,3,3-Tetrafluoroprop-1-ene	0.315	kg CO_2-eq./kg
(Z)-1-Chloro-3,3,3-trifluoroprop-1-ene	0.454	kg CO_2-eq./kg
(Z)-2-Hexen-1-ol	0.003	kg CO_2-eq./kg
1,1,1,2,2,3,4,5,5,5-decafluoro-3-methoxy-4-(trifluoromethyl)pentane	405	kg CO_2-eq./kg
1,1,1,3,3,3-Hexafluoropropan-2-ol	206	kg CO_2-eq./kg
1,1,1-Trichloro-2,2,2-trifluoroethane	3930	kg CO_2-eq./kg
1,1,1-Trifluorobutan-2-one	0.095	kg CO_2-eq./kg
1,1,1-Trifluoropropan-2-one	0.09	kg CO_2-eq./kg
1,1,2,2,3,3,4-heptafluorocyclopentane	231	kg CO_2-eq./kg
1,1,2,2,3,3-hexafluorocyclopentane	120	kg CO_2-eq./kg
1,1-Dichloro-1,2,2,2-tetrafluoroethane	7420	kg CO_2-eq./kg
1,1-Dichloro-2,2-difluoroethane	70.4	kg CO_2-eq./kg
1,1-dichloro-2,2-difluoroethene	0.021	kg CO_2-eq./kg
1,2,2-Trichloro-1,1-difluoroethane	56.4	kg CO_2-eq./kg

1,2-Dichloro-1,2-difluoroethane	122	kg CO_2-eq./kg
1,2-dichloro-1,2-difluoroethene	0.126	kg CO_2-eq./kg
1,3,3,4,4,5,5-heptafluorocyclopentene	45.1	kg CO_2-eq./kg
1,3,3,4,4-pentafluorocyclobutene	92.4	kg CO_2-eq./kg
1-Butene, 1,3,4,4,4-pentafluoro-3-(trifluoromethyl)-, (1E)-	8.22	kg CO_2-eq./kg
1-Pentene, 3,3,4,4,5,5,5-heptafluoro-	0.235	kg CO_2-eq./kg
1-Propanol, i-3,3,3-trifluoro-2,2-bis(trifluoromethyl)-, i-HFE-7100	437	kg CO_2-eq./kg
1-Propanol, n-3,3,3-trifluoro-2,2-bis(trifluoromethyl)-, n-HFE-7100	544	kg CO_2-eq./kg
1-Propene, 3,3,3-trifluoro-2-(trifluoromethyl)-	0.377	kg CO_2-eq./kg
1-Undecanol, 3,3,4,4,5,5,6,6,7,7,8,8,9,9,10,10,11,11,11-nonadecafluoro-	0.273	kg CO_2-eq./kg
2-(Trifluoromethyl)-3-ethoxydodecafluorohexane	13	kg CO_2-eq./kg
2,2-Difluoro-1,2,2,2-tetrachloroethane	3550	kg CO_2-eq./kg
2,3,3,3-Tetrafluoropropene	0.501	kg CO_2-eq./kg
2-Bromopropane	0.126	kg CO_2-eq./kg
2-Chloroethyl vinyl ether	0	kg CO_2-eq./kg
2-Methyl-3-pentanone	0.2	kg CO_2-eq./kg
3,3,4,4-tetrafluorocyclobutene	25.6	kg CO_2-eq./kg
3-Butenenitrile	0	kg CO_2-eq./kg
Acetate, methyl 2,2,2-trifluoro-	82.3	kg CO_2-eq./kg
Allyl ether	0	kg CO_2-eq./kg
Allyl ethyl ether	0	kg CO_2-eq./kg
Allyl trifluoroacetate	0.007	kg CO_2-eq./kg
Bromoform	0.25	kg CO_2-eq./kg
Bromopropane	0.052	kg CO_2-eq./kg
Butane	0.006	kg CO_2-eq./kg
Butane, 1,1,1,2,2,3,3,4,4-nonafluoro-, HFC-329p	2890	kg CO_2-eq./kg
Butane, 1,1,1,2,2,3,3,4,4-nonafluoro-4-methoxy-	460	kg CO_2-eq./kg
Butane, 1,1,1,3,3-pentafluoro-, HFC-365mfc	914	kg CO_2-eq./kg
Butane, 1-chloro-	0.007	kg CO_2-eq./kg
Butane, perfluoro-	10000	kg CO_2-eq./kg
Butane, perfluorocyclo-, PFC-318	10200	kg CO_2-eq./kg
Butanol, 2,2,3,3,4,4,4-heptafluoro-	36.5	kg CO_2-eq./kg
Butanol, 2,2,3,4,4,4-hexafluoro-1-	30.5	kg CO_2-eq./kg
Carbon dioxide	1	kg CO_2-eq./kg
Carbon dioxide, fossil	1	kg CO_2-eq./kg
Carbon dioxide, peat oxidation	1	kg CO_2-eq./kg
Carbon dioxide, to soil or biomass stock	-1	kg CO_2-eq./kg

Chloroform	20.6	kg CO_2-eq./kg
cis-Perfluorodecalin	7800	kg CO_2-eq./kg
Crotonaldehyde	0	kg CO_2-eq./kg
Decamethylcyclopentasiloxane	0.289	kg CO_2-eq./kg
Decamethyltetrasiloxane	0.176	kg CO_2-eq./kg
Decane, 1,1,...,15,15-eicosafluoro-2,5,8,11,14-Pentaoxapenta-	4380	kg CO_2-eq./kg
Decane, 3,3,4,4,6,6,7,7,9,9,10,10-dodecafluoro-2,5,8,11-tetraoxado-	219	kg CO_2-eq./kg
Dinitrogen monoxide	273	kg CO_2-eq./kg
Dinitrogen monoxide, peat oxidation	273	kg CO_2-eq./kg
Dodecamethylcyclohexasiloxane	0.142	kg CO_2-eq./kg
Dodecamethylpentasiloxane	0.122	kg CO_2-eq./kg
EPTE-furan	48.7	kg CO_2-eq./kg
Ethane	0.437	kg CO_2-eq./kg
Ethane, 1,1,1,2-tetrafluoro-, HFC-134a	1526	kg CO_2-eq./kg
Ethane, 1,1,1,2-tetrafluoro-2-bromo-, Halon 2401	201	kg CO_2-eq./kg
Ethane, 1,1,1-trichloro-, HCFC-140	161	kg CO_2-eq./kg
Ethane, 1,1,1-trifluoro-, HFC-143a	5810	kg CO_2-eq./kg
Ethane, 1,1,1-trifluoro-2-bromo-	177	kg CO_2-eq./kg
Ethane, 1,1,2,2-tetrachloro-1,2-difluoro-, CFC-112	4620	kg CO_2-eq./kg
Ethane, 1,1,2,2-tetrachloro-1-fluoro-, HCFC-121	58.3	kg CO_2-eq./kg
Ethane, 1,1,2,2-tetrafluoro-, HFC-134	1260	kg CO_2-eq./kg
Ethane, 1,1,2,2-tetrafluoro-1,2-dimethoxy-	202	kg CO_2-eq./kg
Ethane, 1,1,2,2-tetrafluoro-1-methoxy-2-(1,1,2,2-tetrafluoro-2-methoxyethoxy)-	229	kg CO_2-eq./kg
Ethane, 1,1,2-trichloro-1,2,2-trifluoro-, CFC-113	6520	kg CO_2-eq./kg
Ethane, 1,1,2-trichloro-1,2-difluoro-, HCFC-122a	245	kg CO_2-eq./kg
Ethane, 1,1,2-trifluoro-, HFC-143	364	kg CO_2-eq./kg
Ethane, 1,1-dichloro-1,2-difluoro-, HCFC-132c	342	kg CO_2-eq./kg
Ethane, 1,1-dichloro-1-fluoro-, HCFC-141b	860	kg CO_2-eq./kg
Ethane, 1,1-difluoro-, HFC-152a	164	kg CO_2-eq./kg
Ethane, 1,2-dibromo-	1.02	kg CO_2-eq./kg
Ethane, 1,2-dibromotetrafluoro-, Halon 2402	2170	kg CO_2-eq./kg
Ethane, 1,2-dichloro-	1.3	kg CO_2-eq./kg
Ethane, 1,2-dichloro-1,1,2,2-tetrafluoro-, CFC-114	9430	kg CO_2-eq./kg
Ethane, 1,2-dichloro-1,1,2-trifluoro-, HCFC-123a	395	kg CO_2-eq./kg
Ethane, 1,2-dichloro-1-fluoro-, HCFC-141	46.6	kg CO_2-eq./kg
Ethane, 1,2-difluoro-, HFC-152	21.5	kg CO_2-eq./kg
Ethane, 1-chloro-1,1,2,2-tetrafluoro-, HCFC-124a	2070	kg CO_2-eq./kg
Ethane, 1-chloro-1,1-difluoro-, HCFC-142b	2300	kg CO_2-eq./kg

Ethane, 1-chloro-2,2,2-trifluoro-(difluoromethoxy)-, HCFE-235da2	539	kg CO_2-eq./kg
Ethane, 2,2-dichloro-1,1,1-trifluoro-, HCFC-123	90.4	kg CO_2-eq./kg
Ethane, 2-chloro-1,1,1,2-tetrafluoro-, HCFC-124	597	kg CO_2-eq./kg
Ethane, 2-chloro-1,1,1-trifluoro-, HCFC-133a	388	kg CO_2-eq./kg
Ethane, 2-chloro-1,1,2-trifluoro-1-methoxy-	136	kg CO_2-eq./kg
Ethane, bromo-	0.487	kg CO_2-eq./kg
Ethane, chloro-	0.481	kg CO_2-eq./kg
Ethane, chloropentafluoro-, CFC-115	9600	kg CO_2-eq./kg
Ethane, fluoro-, HFC-161	4.84	kg CO_2-eq./kg
Ethane, hexafluoro-, HFC-116	12400	kg CO_2-eq./kg
Ethane, pentafluoro-, HFC-125	3740	kg CO_2-eq./kg
Ethanol, 2,2,2-trifluoro-	35.7	kg CO_2-eq./kg
Ethanol, 2,2-difluoro-	6.18	kg CO_2-eq./kg
Ethanol, 2-fluoro-	0.53	kg CO_2-eq./kg
Ethene, 1,1,2-trifluoro-2-(trifluoromethoxy)-	0.01	kg CO_2-eq./kg
Ethene, 1,1-difluoro-, HFC-1132a	0.052	kg CO_2-eq./kg
Ether, 1,1,1-trifluoromethyl methyl-, HFE-143a	616	kg CO_2-eq./kg
Ether, 1,1,2,2-Tetrafluoroethyl 2,2,2-trifluoroethyl-, HFE-347mcc3	576	kg CO_2-eq./kg
Ether, 1,1,2,2-Tetrafluoroethyl 2,2,2-trifluoroethyl-, HFE-347mcf2	963	kg CO_2-eq./kg
Ether, 1,1,2,2-Tetrafluoroethyl 2,2,2-trifluoroethyl-, HFE-347pcf2	980	kg CO_2-eq./kg
Ether, 1,1,2,2-Tetrafluoroethyl methyl-, HFE-254cb2	328	kg CO_2-eq./kg
Ether, 1,1,2,3,3,3-Hexafluoropropyl methyl-, HFE-356mec3	264	kg CO_2-eq./kg
Ether, 1,1,2,3,3,3-Hexafluoropropyl methyl-, HFE-356pcc3	277	kg CO_2-eq./kg
Ether, 1,1,2,3,3,3-Hexafluoropropyl methyl-, HFE-356pcf2	831	kg CO_2-eq./kg
Ether, 1,1,2,3,3,3-Hexafluoropropyl methyl-, HFE-356pcf3	484	kg CO_2-eq./kg
Ether, 1,2,2-trifluoroethyl trifluoromethyl-, HFE-236ea2	1260	kg CO_2-eq./kg
Ether, 1,2,2-trifluoroethyl trifluoromethyl-, HFE-236fa	1100	kg CO_2-eq./kg
Ether, 2,2,3,3,3-Pentafluoropropyl methyl-, HFE-365mcf3	1.6	kg CO_2-eq./kg
Ether, 2-chloro-1,1,2-trifluoroethyl difluoromethyl-, HCFE-235ca2 (enflurane)	654	kg CO_2-eq./kg
Ether, bis(2,2,2-trifluoroethyl)-	24.4	kg CO_2-eq./kg
Ether, di(difluoromethyl), HFE-134	6630	kg CO_2-eq./kg
Ether, difluoromethyl 1,2,2,2-tetrafluoroethyl-, HFE-236ea2 (desflurane)	2590	kg CO_2-eq./kg
Ether, difluoromethyl 2,2,2-trifluoroethyl-, HFE-245cb2	747	kg CO_2-eq./kg
Ether, difluoromethyl 2,2,2-trifluoroethyl-, HFE-245fa1	934	kg CO_2-eq./kg
Ether, difluoromethyl 2,2,2-trifluoroethyl-, HFE-245fa2	878	kg CO_2-eq./kg

Ether, ethyl 1,1,2,2-tetrafluoroethyl-, HFE-374pc2	12.5	kg CO_2-eq./kg
Ether, ethyl trifluoromethyl-, HFE-263m1	29.2	kg CO_2-eq./kg
Ether, i-nonafluorobutane ethyl-, HFE569sf2 (i-HFE-7200)	34.3	kg CO_2-eq./kg
Ether, nonafluorobutane ethyl-, HFE569sf2 (HFE-7200)	60.7	kg CO_2-eq./kg
Ether, pentafluoromethyl-, HFE-125	14300	kg CO_2-eq./kg
Ethyl methyl ether	0.01	kg CO_2-eq./kg
Fluoroxene	0.058	kg CO_2-eq./kg
Formate, 1,1,1,3,3,3-hexafluoropropan-2-yl-	269	kg CO_2-eq./kg
Formate, 2,2,2-trifluoroethyl-	54.8	kg CO_2-eq./kg
Formate, perfluoroethyl-	597	kg CO_2-eq./kg
Halothane	45	kg CO_2-eq./kg
Heptacosafluorotributylamine	8490	kg CO_2-eq./kg
Heptafluoroisobutyronitrile	2750	kg CO_2-eq./kg
Heptanol, 3,3,4,4,5,5,6,6,7,7,7-undecafluoro-	0.533	kg CO_2-eq./kg
Hexafluorocyclobutene	126	kg CO_2-eq./kg
Hexamethylcyclotrisiloxane	1.15	kg CO_2-eq./kg
Hexamethyldisiloxane	0.476	kg CO_2-eq./kg
Hexane, perfluoro-	8620	kg CO_2-eq./kg
HFE-227EA	7520	kg CO_2-eq./kg
HFE-236ca12 (HG-10)	6060	kg CO_2-eq./kg
HFE-263fb2	2.06	kg CO_2-eq./kg
HFE-329mcc2	3770	kg CO_2-eq./kg
HFE-338mcf2	1040	kg CO_2-eq./kg
HFE-338pcc13 (HG-01)	3320	kg CO_2-eq./kg
HFE-43-10pccc124 (H-Galden1040x)	3220	kg CO_2-eq./kg
HG-02	5730	kg CO_2-eq./kg
HG-03	5350	kg CO_2-eq./kg
Methane	29.8	kg CO_2-eq./kg
Methane, bromo-, Halon 1001	2.43	kg CO_2-eq./kg
Methane, bromochlorodifluoro-, Halon 1211	1930	kg CO_2-eq./kg
Methane, bromodifluoro-, Halon 1201	380	kg CO_2-eq./kg
Methane, bromotrifluoro-, Halon 1301	7200	kg CO_2-eq./kg
Methane, chlorobromo-, Halon 1011	4.74	kg CO_2-eq./kg
Methane, chlorodifluoro-, HCFC-22	1960	kg CO_2-eq./kg
Methane, chlorofluoro-, HCFC-31	79.4	kg CO_2-eq./kg
Methane, chlorotrifluoro-, CFC-13	16200	kg CO_2-eq./kg
Methane, dibromo-	1.51	kg CO_2-eq./kg
Methane, dibromodifluoro-, Halon 1202	216	kg CO_2-eq./kg
Methane, dichloro-, HCC-30	11.2	kg CO_2-eq./kg

Methane, dichlorodifluoro-, CFC-12	12500	kg CO_2-eq./kg
Methane, dichlorofluoro-, HCFC-21	160	kg CO_2-eq./kg
Methane, difluoro(methoxy)-	136	kg CO_2-eq./kg
Methane, difluoro-, HFC-32	771	kg CO_2-eq./kg
Methane, fluoro-, HFC-41	135	kg CO_2-eq./kg
Methane, fossil	29.8	kg CO_2-eq./kg
Methane, monochloro-, R-40	5.54	kg CO_2-eq./kg
Methane, peat oxidation	29.8	kg CO_2-eq./kg
Methane, tetrachloro-, CFC-10	2200	kg CO_2-eq./kg
Methane, tetrafluoro-, CFC-14	7380	kg CO_2-eq./kg
Methane, trichlorofluoro-, CFC-11	6226	kg CO_2-eq./kg
Methane, trifluoro-, HFC-23	14600	kg CO_2-eq./kg
Methyl perfluoroisopropyl ether	392	kg CO_2-eq./kg
Methyl-perfluoroheptene-ethers	15.1	kg CO_2-eq./kg
Methylvinylketone	0	kg CO_2-eq./kg
Nitrogen fluoride	17400	kg CO_2-eq./kg
Nonanol, 3,3,4,4,5,5,6,6,7,7,8,8,9,9,9-pentadecafluoro-	0.449	kg CO_2-eq./kg
Octa deca fluoro octane	8260	kg CO_2-eq./kg
Octafluorotetrahydrofuran	13900	kg CO_2-eq./kg
Octamethyltetrasiloxane	0.739	kg CO_2-eq./kg
Octamethyltrisiloxane	0.325	kg CO_2-eq./kg
Pentadecafluorotriethylamine	10300	kg CO_2-eq./kg
Pentafluorobutene-1	0.182	kg CO_2-eq./kg
Pentane, 2,3-dihydroperfluoro-, HFC-4310mee	1600	kg CO_2-eq./kg
Pentane, perfluoro-	9220	kg CO_2-eq./kg
Pentanol, 2,2,3,3,4,4,5,5-octafluorocyclo-	13.6	kg CO_2-eq./kg
Pentanone, 1,1,1,2,2,4,5,5,5-nonafluoro-4-(trifluoromethyl)-3-	0.114	kg CO_2-eq./kg
Perfluorobut-1-ene	0.102	kg CO_2-eq./kg
Perfluorobut-2-ene	1.97	kg CO_2-eq./kg
Perfluorobuta-1,3-diene	0.004	kg CO_2-eq./kg
Perfluorocyclopentene	78.1	kg CO_2-eq./kg
Perfluorodecalin (trans)	7120	kg CO_2-eq./kg
Perfluoroheptane	8410	kg CO_2-eq./kg
Perfluoropropene	0.09	kg CO_2-eq./kg
Perfluorotripentylamine	7260	kg CO_2-eq./kg
Perfluorotripropylamine	9030	kg CO_2-eq./kg
PFC-9-1-18	7480	kg CO_2-eq./kg
PFPMIE	10300	kg CO_2-eq./kg
Propanal, 3,3,3-trifluoro-	0.025	kg CO_2-eq./kg

Propane	0.02	kg CO_2-eq./kg
Propane, 1,1,1,2,2,3,3-heptafluoro-, HFC-227ca	2980	kg CO_2-eq./kg
Propane, 1,1,1,2,2,3,3-heptafluoro-3-(1,2,2,2-tetrafluoroethoxy)-	6630	kg CO_2-eq./kg
Propane, 1,1,1,2,2,3-hexafluoro-, HFC-236cb	1350	kg CO_2-eq./kg
Propane, 1,1,1,2,2-pentafluoro-, HFC-245cb	4550	kg CO_2-eq./kg
Propane, 1,1,1,2,3,3,3-heptafluoro-, HFC-227ea	3600	kg CO_2-eq./kg
Propane, 1,1,1,2,3,3-hexafluoro-, HFC-236ea	1500	kg CO_2-eq./kg
Propane, 1,1,1,2,3,3-hexafluoro-3-(trifluoromethoxy)-, HFE-329me3	4390	kg CO_2-eq./kg
Propane, 1,1,1,2,3-pentafluoro-, HFC-245eb	325	kg CO_2-eq./kg
Propane, 1,1,1,3,3,3-hexafluoro-, HCFC-236fa	8690	kg CO_2-eq./kg
Propane, 1,1,1,3,3,3-Hexafluoro-2-(difluoromethoxy)	3040	kg CO_2-eq./kg
Propane, 1,1,1,3,3,3-hexafluoro-2-(fluoromethoxy)-	195	kg CO_2-eq./kg
Propane, 1,1,1,3,3,3-hexafluoro-2-methoxy-(9CI)	8.13	kg CO_2-eq./kg
Propane, 1,1,1,3,3-pentafluoro-, HFC-245fa	962	kg CO_2-eq./kg
Propane, 1,1,1-trifluoro-, HFC-263fb	74.8	kg CO_2-eq./kg
Propane, 1,1,2,2,3-pentafluoro-, HFC-245ca	787	kg CO_2-eq./kg
Propane, 1,1,2,2-tetrafluoro-3-methoxy-	1.68	kg CO_2-eq./kg
Propane, 1,1,2,3,3-pentafluoro-, HFC-245ea	255	kg CO_2-eq./kg
Propane, 1,3-dichloro-1,1,2,2,3-pentafluoro-, HCFC-225cb	568	kg CO_2-eq./kg
Propane, 1-ethoxy-1,1,2,3,3,3-hexafluoro-	26.4	kg CO_2-eq./kg
Propane, 2,2-difluoro-, HFC-272ca	599	kg CO_2-eq./kg
Propane, 2-chloro-	0.181	kg CO_2-eq./kg
Propane, 3,3-dichloro-1,1,1,2,2-pentafluoro-, HCFC-225ca	137	kg CO_2-eq./kg
Propane, perfluoro-	9290	kg CO_2-eq./kg
Propanol, 2,2,3,3-tetrafluoro-1-	14.4	kg CO_2-eq./kg
Propanol, 3,3,3-trifluoro-1-	0.62	kg CO_2-eq./kg
Propanol, pentafluoro-1-	34.3	kg CO_2-eq./kg
Sulfur hexafluoride	24300	kg CO_2-eq./kg
Sulfuryl fluoride	4630	kg CO_2-eq./kg
Tetrachloroethylene	6.34	kg CO_2-eq./kg
Tetrafluoroethylene	0.004	kg CO_2-eq./kg
trans-1,3,3,3-Tetrafluoropropene	1.37	kg CO_2-eq./kg
trans-1H,2H-Octafluorocyclopentane	258	kg CO_2-eq./kg
Trichloroethylene	0.044	kg CO_2-eq./kg
Trifluorobutanol	0.049	kg CO_2-eq./kg
Trifluoroethyl acetate	1.58	kg CO_2-eq./kg
Trifluoroethylene	0.005	kg CO_2-eq./kg
Trifluoromethylsulfur pentafluoride	18500	kg CO_2-eq./kg

Trifluoropropene, HFC-1243zf	0.261	kg CO_2-eq./kg
Vinyl trifluoroacetate	0.008	kg CO_2-eq./kg
Vinylfluoride	0.024	kg CO_2-eq./kg

Table 2 Characterization factors for substances contributing to emissions of biogenic CO_2-equivalents. The unit is kg CO_2-eq./kg substance.

Substances	Characterization factor	Unit
Carbon dioxide, biogenic	1	kg CO_2e/kg
Methane, biogenic	29.8	kg CO_2e/kg

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WEBSITE

www.norsus.no

E-MAIL

post@norsus.no

ORG.NO.

989 861 751 MVA

ADDRESS

Stadion 4, N-1671 Kråkerøy