

Report

SUSTAINABLE INNOVATION

Author(s): Ellen Soldal and Ingunn Saur Modahl**Report no.:** OR. 17.17**ISBN:** 978-82-7520-763-8

Greenhouse gas protocol Scope 3 reporting Borregaard 2016

Report no.: OR.17.17

ISBN no.: 978-82-7520-763-8

Report type:

ISSN no.: 0803-6659

Commissioned report

Report title:

Greenhouse gas protocol Scope 3 reporting

Borregaard 2016

Author(s): Ellen Soldal and Ingunn Saur Modahl

Project number: 1840

Project title: GHG reporting Borregaard

Commissioned by:

Borregaard AS

Company contact:

Kjersti Garseg Gyllensten

Keywords:

- GHG protocol
- Scope 3
- Biorefinery
- Corporate value chain

Confidentiality:

Open

Number of pages:

24

Approved:

Date: 21.06.2017

Project Manager



Research Manager



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
Description of the company	Borregaard is a biorefinery that produces advanced biochemicals that can replace oil-based products. Borregaard employs 1010 man-years in plants and sales offices in 16 countries throughout Europe, America, Asia and Africa.
Chosen consolidation approach (equity share, operational control or financial control)	Operations under full control of Borregaard are included.
Description of the businesses and operations included in the company's organizational boundary	Operations in Norway, UK, USA, Austria and Germany are included. However, for the operations in UK, USA, Austria and Germany, only energy consumption is included. Borregaard Norway accounts for most of the purchased goods and energy consumption (97% of total energy consumed at Borregaard Norway).
The reporting period covered	01/01/2016 -12/31/2016
A list of scope 3 activities included in the report	Category 1: Purchased goods & services 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

	<p>Category 7: Employee commuting Category 9: Downstream transportation and distribution Category 11: Use of sold products Category 12: End-of-life treatment of sold products Category 15: Operation of investments</p>
<p>A list of scope 1, scope 2, and scope 3 activities excluded from the report with justification for their exclusion</p>	<p>Category 8 (Upstream leased assets), Category 13 (Downstream leased assets) and Category 14 (Franchises) are excluded because they are not relevant to Borregaard. Category 10 (Processing of sold products) is excluded because Borregaard produces mainly intermediate goods and data for all final products is difficult to obtain because they are distributed to a variety of different productions. Category 2 (Capital goods) is excluded due to lack of data.</p>
<p>The year chosen as base year and rationale for choosing the base year¹</p>	
<p>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.</p>	

¹ If a company has different base years for different scopes, base year information should be provided separately for each scope. Establishing a base year is required for scope 1 and 2 emissions, and required for scope 3 emissions when companies choose to track performance or set a reduction target.

Part 2: Greenhouse gas emissions data

Scopes and categories ²	Metric tons CO ₂ e
Scope 1: Direct emissions from owned/controlled operations	134 176
Scope 2: Indirect emissions from the use of purchased electricity, steam, heating, and cooling	60 785
Upstream scope 3 emissions	
Category 1: Purchased goods and services	98 639
Category 2: Capital goods	-
Category 3: Fuel- and energy-related activities (not included in scope 1 or scope 2)	9 845
Category 4: Upstream transportation and distribution	15 168
Category 5: Waste generated in operations	899
Category 6: Business travel	1 213
Category 7: Employee commuting	232
Category 8: Upstream leased assets	-
Other	
Downstream scope 3 emissions	
Category 9: Downstream transportation and distribution	34 259
Category 10: Processing of sold products	-
Category 11: Use of sold products	0
Category 12: End-of-life treatment of sold products	0
Category 13: Downstream leased assets	-
Category 14: Franchises	-
Category 15: Investments ³	31 305
Other	-

² 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.

³ 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 2: Greenhouse gas emissions data (continued)

Greenhouse gas emissions	CO ₂		CH ₄		N ₂ O		HFCs		PFCs		SF ₆	
	Metric tons CO ₂	Metric tons CO ₂ e	Metric tons CH ₄	Metric tons CO ₂ e	Metric tons N ₂ O	Metric tons CO ₂ e	Metric tons of each HFC	Metric tons CO ₂ e	Metric tons of each PFC	Metric tons CO ₂ e	Metric tons SF ₆	Metric tons CO ₂ e
Scope 1		134 176	-	-	-	-	-	-	-	-	-	-
Scope 2		60 785	-	-	-	-	-	-	-	-	-	-

Part 3: Biogenic CO₂ emissions data (if applicable)

Scopes and categories	Metric tons biogenic CO ₂
Direct biogenic CO ₂ emissions from owned/controlled operations	108 152
Indirect biogenic CO ₂ emissions from the use of purchased electricity, steam, heating, and cooling	373
Indirect biogenic CO ₂ emissions - Upstream	
Purchased goods and services	5 426
Capital goods	-
Fuel- and energy-related activities (not included in scope 1 or scope 2)	72
Upstream transportation and distribution	142
Waste generated in operations	2 698
Business travel	3
Employee commuting	2
Upstream leased assets	-
Other	-
Indirect biogenic CO ₂ emissions - Downstream	
Downstream transportation and distribution	283
Processing of sold products	-
Use of sold products	14 168
End-of-life treatment of sold products	480 156
Downstream leased assets	-
Franchises	-
Investments ⁴	125
Other	-

⁴ 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 4: Description of methodologies and data used

Scope	Methodologies used to calculate or measure emissions, providing a reference or link to any calculation tools used
Scope 1	
Scope 2	

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 some suppliers. Secondary data obtained as cradle-to-gate emissions factors from the commercially and	Good	Hybrid method. For characterization of the GHG emissions and emissions of biogenic CO ₂ , the Greenhouse Gas Protocol method has been applied (Goedkoop 2010, updated in 2016).	37%

	publicly available database Ecoinvent ver. 3.3.			
Category 2: Capital goods	-			
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. 3.3.	Good	Hybrid method. For characterization of the GHG emissions and emissions of biogenic CO ₂ , the Greenhouse Gas Protocol method has been applied (Goedkoop 2010, updated in 2016).	0%
Category 4: Upstream transportation and distribution	Activity data (primary data) obtained from Borregaard. Secondary data (emissions factors) obtained from the commercially and	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	58%

	publicly available database Ecoinvent ver. 3.3.		and emissions of biogenic CO ₂ , the Greenhouse Gas Protocol method has been applied (Goedkoop 2010, updated in 2016).	
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. 3.3.	Good	Hybrid method. For characterization of the GHG emissions and emissions of biogenic CO ₂ , the Greenhouse Gas Protocol method has been applied (Goedkoop 2010, updated in 2016).	0%
Category 6: Business travel	Activity data (number of business travels) obtained from Borregaard. Emissions factors (secondary data) obtained from the commercially and	Fair	Assume same number of business travels as in 2015. Only air travels are included. Assume average distance per flight, divided into domestic (60 kg CO ₂ -eq./trip), continental (144 kg CO ₂ -eq./trip) and	0%

	publicly available database Ecoinvent ver. 3.3.		intercontinental (842 kg CO ₂ -eq./trip). For characterization of the GHG emissions and emissions of biogenic CO ₂ , the Greenhouse Gas Protocol method has been applied (Goedkoop 2010, updated in 2016).	
Category 7: Employee commuting	Activity data obtained from Borregaard. Emissions factors (secondary data) obtained from the commercially and publicly available database Ecoinvent ver. 3.3.	Fair	25% of the employee commuting is based on reported data, while 75% is estimated. Assume the same share of diesel, gasoline and electric car as in Norway as total (2016). For characterization of the GHG emissions and emissions of biogenic CO ₂ , the Greenhouse Gas Protocol method has been applied (Goedkoop 2010, updated in 2016).	0%

Category 8: Upstream leased assets	-			
Other	-			

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	Modes of transport for each product and amount of product obtained from Borregaard. Transport distances not available. Emissions factors (secondary data) obtained from the commercially and publicly available database Ecoinvent ver. 3.3.	Fair	Because actual transport distances lacked, 1000 km of transport is used (as in EPD developed for Borregaard). Due to lack of data, category 9 includes only transport of eight out of nine products. For characterization of the GHG emissions and emissions of biogenic CO ₂ , the Greenhouse Gas Protocol method has been applied	0%

			(Goedkoop 2010, updated in 2016).	
Category 10: Processing of sold products	-			
Category 11: Use of sold products	Data on amounts of sold products obtained from Borregaard.	Good	Borregaard's products are produced from wood and used as performance chemicals. Hence, it is assumed that they do not cause emissions of GHG in use. Ethanol 96% is used as bioethanol. Combustion of bioethanol causes emissions of biogenic CO ₂ , which is calculated based on carbon content of ethanol multiplied with the molecular weight ratio carbon to CO ₂ . For characterization of the GHG emissions and emissions of biogenic CO ₂ , the Greenhouse Gas	

			Protocol method has been applied (Goedkoop 2010, updated in 2016).	
Category 12: End-of-life treatment of sold products	Specific information on carbon content and amount of sold products obtained from Borregaard.	Good	<p>Due to biological origin, the sold products are assumed to not cause emissions of GHG in end-of-life treatment. Emissions of biogenic CO₂ from end-of-life treatment calculated based on carbon content of sold products multiplied with the molecular weight ratio carbon to CO₂.</p> <p>For characterization of the GHG emissions and emissions of biogenic CO₂, the Greenhouse Gas Protocol method has been applied (Goedkoop 2010, updated in 2016).</p>	

Category 13: Downstream leased assets	-			
Category 14: Franchises	-			
Category 15: Investments ⁵	Activity data (primary data) obtained from Borregaard. Secondary data (emissions factors) for electricity obtained from Re-DISS 2015 European Residual Mixes (2015). Emissions of biogenic CO ₂ from the commercially and publicly available database Ecoinvent ver. 3.3.	Good	Borregaard has a 50% interest in Umkomaas Ligning Ltd. In South-Africa, and accounts proportionally for Scope 1 and Scope 2 emissions from the joint venture.	
Other	-			

⁵ 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.

(If applicable)

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

Scopes and categories ⁶	Metric tons CO ₂ e
Scope 1: Direct emissions from owned/controlled operations	
Scope 2: Indirect emissions from the use of purchased electricity, steam, heating, and cooling	
Upstream scope 3 emissions	
Category 1: Purchased goods and services	
Category 2: Capital goods	
Category 3: Fuel- and energy-related activities (not included in scope 1 or scope 2)	
Category 4: Upstream transportation and distribution	
Category 5: Waste generated in operations	
Category 6: Business travel	
Category 7: Employee commuting	
Category 8: Upstream leased assets	
Other	
Downstream scope 3 emissions	
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 13: Downstream leased assets	
Category 14: Franchises	
Category 15: Investments ⁷	
Other	

⁶ 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.

⁷ 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 Greenhouse Gas Protocol V1.02

Table 1 and 2 give the characterization factors used in this reporting, fossil and biogenic CO₂ respectively.

Table 1 Characterization factors for substances contributing to emissions of fossil CO₂-equivalents. The unit is kg CO₂-eq./kg substance.

Substances	Characterization factor
(E)-1-Chloro-3,3,3-trifluoroprop-1-ene	1
(E)-1,2,3,3,3-Pentafluoroprop-1-ene	0.079
(Perfluorobutyl)ethylene	0.136
(Perfluorooctyl)ethylene	0.0929
(Perfluorohexyl)ethylene	0.108
(Z)-1,1,1,4,4,4-Hexafluorobut-2-ene	2
(Z)-1,2,3,3,3-Pentafluoroprop-1-ene	0.233
(Z)-1,3,3,3-Tetrafluoroprop-1-ene	0.285
1-Propanol, 3,3,3-trifluoro-2,2-bis(trifluoromethyl)-, HFE-7100	421
1-Propanol, i-3,3,3-trifluoro-2,2-bis(trifluoromethyl)-, i-HFE-7100	407
1-Propanol, n-3,3,3-trifluoro-2,2-bis(trifluoromethyl)-, n-HFE-7100	486
1-Undecanol, 3,3,4,4,5,5,6,6,7,7,8,8,9,9,10,10,11,11,11-nonadecafluoro-	0.188
1,1,1,3,3,3-Hexafluoropropan-2-ol	182
1,2,2-Trichloro-1,1-difluoroethane	59
2,3,3,3-Tetrafluoropropene	0.352
Acetate, 1,1-difluoroethyl 2,2,2-trifluoro-	31
Acetate, 2,2,2-trifluoroethyl 2,2,2-trifluoro-	7
Acetate, difluoromethyl 2,2,2-trifluoro-	27
Acetate, methyl 2,2-difluoro-	3
Acetate, methyl 2,2,2-trifluoro-	52
Acetate, perfluorobutyl-	2
Acetate, perfluoroethyl-	2
Acetate, perfluoropropyl-	2
Acetate, trifluoromethyl-	2
Butane, 1,1,1,2,2,3,3,4,4-nonafluoro-, HFC-329p	2360
Butane, 1,1,1,3,3-pentafluoro-, HFC-365mfc	804
Butane, perfluoro-	9200
Butane, perfluorocyclo-, PFC-318	9540
Butanol, 2,2,3,3,4,4,4-heptafluoro-	34

Butanol, 2,2,3,3,4,4,4-heptafluoro-1-	16
Butanol, 2,2,3,4,4,4-hexafluoro-1-	17
Carbon dioxide	1
Carbon dioxide, fossil	1
Carbon dioxide, land transformation	1
Chloroform	16
Cis-perfluorodecalin	7240
Decane, 1,1,...,15,15-eicosafluoro-2,5,8,11,14-Pentaoxapenta-	3630
Decane, 1,1,3,3,4,4,6,6,7,7,9,9,10,10,12,12-hexadecafluoro-2,5,8,11-tetraoxado-	2850
Decane, 1,1,3,3,5,5,7,7,8,8,10,10-dodecafluoro-2,4,6,9-tetraoxa-	3890
Decane, 1,1,3,3,5,5,7,7,9,9-decafluoro-2,4,6,8-tetraoxanonane-	7330
Decane, 3,3,4,4,6,6,7,7,9,9,10,10-dodecafluoro-2,5,8,11-tetraoxado-	221
Dinitrogen monoxide	265
EPTE-furan	56
Ethane, 1-(difluoromethoxy)-1,1,2,2-tetrafluoro-	4240
Ethane, 1-chloro-1,1-difluoro-, HCFC-142b	1980
Ethane, 1-chloro-2,2,2-trifluoro-(difluoromethoxy)-, HCFE-235da2	491
Ethane, 1-ethoxy-1,1,2,2,2-pentafluoro-	58
Ethane, 1,1'-oxybis[2-(difluoromethoxy)-1,1,2,2-tetrafluoro-	4920
Ethane, 1,1-dichloro-1-fluoro-, HCFC-141b	782
Ethane, 1,1-dichloro-1,2-difluoro-, HCFC-132c	338
Ethane, 1,1-difluoro-, HFC-152a	138
Ethane, 1,1,1-trichloro-, HCFC-140	160
Ethane, 1,1,1-trifluoro-, HFC-143a	4800
Ethane, 1,1,1-trifluoro-2-bromo-	173
Ethane, 1,1,1,2-tetrafluoro-, HFC-134a	1300
Ethane, 1,1,1,2-tetrafluoro-2-bromo-, Halon 2401	184
Ethane, 1,1,2-trichloro-1,2-difluoro-, HCFC-122a	258
Ethane, 1,1,2-trichloro-1,2,2-trifluoro-, CFC-113	5820
Ethane, 1,1,2-trifluoro-, HFC-143	328
Ethane, 1,1,2,2-tetrafluoro-, HFC-134	1120
Ethane, 1,1,2,2-tetrafluoro-1-(fluoromethoxy)-	871
Ethane, 1,1,2,2-tetrafluoro-1-methoxy-2-(1,1,2,2-tetrafluoro-2-methoxyethoxy)-	236
Ethane, 1,1,2,2-tetrafluoro-1,2-dimethoxy-	222
Ethane, 1,2-dibromotetrafluoro-, Halon 2402	1470
Ethane, 1,2-dichloro-	0.898
Ethane, 1,2-dichloro-1,1,2-trifluoro-, HCFC-123a	370
Ethane, 1,2-dichloro-1,1,2,2-tetrafluoro-, CFC-114	8590

Ethane, 1,2-difluoro-, HFC-152	16
Ethane, 2-chloro-1,1,1,2-tetrafluoro-, HCFC-124	527
Ethane, 2-chloro-1,1,2-trifluoro-1-methoxy-	122
Ethane, 2,2-dichloro-1,1,1-trifluoro-, HCFC-123	79
Ethane, chloropentafluoro-, CFC-115	7670
Ethane, fluoro-, HFC-161	4
Ethane, hexafluoro-, HFC-116	11100
Ethane, pentafluoro-, HFC-125	3170
Ethanol, 2-fluoro-	0.88
Ethanol, 2,2-difluoro-	3
Ethanol, 2,2,2-trifluoro-	20
Ethene, 1,1-difluoro-, HFC-1132a	0.0422
Ethene, 1,1,2-trifluoro-2-(trifluoromethoxy)-	0.209
Ether, 1,1,1-trifluoromethyl methyl-, HFE-143a	523
Ether, 1,1,2,2-Tetrafluoroethyl 2,2,2-trifluoroethyl-, HFE-347mcf2	854
Ether, 1,1,2,2-Tetrafluoroethyl 2,2,2-trifluoroethyl-, HFE-347pcf2	889
Ether, 1,1,2,2-Tetrafluoroethyl methyl-, HFE-254cb2	301
Ether, 1,1,2,3,3,3-Hexafluoropropyl methyl-, HFE-356mec3	387
Ether, 1,1,2,3,3,3-Hexafluoropropyl methyl-, HFE-356pcc3	413
Ether, 1,1,2,3,3,3-Hexafluoropropyl methyl-, HFE-356pcf2	719
Ether, 1,1,2,3,3,3-Hexafluoropropyl methyl-, HFE-356pcf3	446
Ether, 1,2,2-trifluoroethyl trifluoromethyl-, HFE-236ea2	1240
Ether, 1,2,2-trifluoroethyl trifluoromethyl-, HFE-236fa	979
Ether, 2-chloro-1,1,2-trifluoroethyl difluoromethyl-, HCFE-235ca2 (enflurane)	583
Ether, 2,2,3,3,3-Pentafluoropropyl methyl-, HFE-365mcf3	0.928
Ether, bis(2,2,2-trifluoroethyl)-	17
Ether, di(difluoromethyl), HFE-134	5560
Ether, difluoromethyl 1,2,2,2-tetrafluoroethyl-, HFE-236ea2 (desflurane)	1790
Ether, difluoromethyl 2,2,2-trifluoroethyl-, HFE-245cb2	654
Ether, difluoromethyl 2,2,2-trifluoroethyl-, HFE-245fa1	828
Ether, difluoromethyl 2,2,2-trifluoroethyl-, HFE-245fa2	812
Ether, ethyl 1,1,2,2-tetrafluoroethyl-, HFE-374pc2	627
Ether, ethyl trifluoromethyl-, HFE-263m1	29
Ether, i-nonafluorobutane ethyl-, HFE569sf2 (i-HFE-7200)	44
Ether, n-nonafluorobutane ethyl-, HFE569sf2 (n-HFE-7200)	65
Ether, nonafluorobutane ethyl-, HFE569sf2 (HFE-7200)	57
Ether, pentafluoromethyl-, HFE-125	12400
Fluoridate, 1,1-difluoroethyl carbono-	27
Fluoridate, methyl carbono-	95
Fluoroxene	0.0542

Formate, 1,1,1,3,3,3-hexafluoropropan-2-yl-	333
Formate, 1,2,2,2-tetrafluoroethyl-	470
Formate, 2,2,2-trifluoroethyl-	33
Formate, 3,3,3-trifluoropropyl-	17
Formate, perfluorobutyl-	392
Formate, perfluoroethyl-	580
Formate, perfluoropropyl-	376
Formate, trifluoromethyl-	588
Halothane	41
Heptanol, 3,3,4,4,5,5,6,6,7,7,7-undecafluoro-	0.426
Hexane, perfluoro-	7910
HFE-227EA	6450
HFE-236ca12 (HG-10)	5350
HFE-263fb2	1
HFE-329mcc2	3070
HFE-338mcf2	929
HFE-338pcc13 (HG-01)	2910
HFE-43-10pccc124 (H-Galden1040x)	2820
HG-02	2730
HG-03	2850
Methane	30.5
Methane, (difluoromethoxy)((difluoromethoxy)difluoromethoxy)difluoro-	5300
Methane, bromo-, Halon 1001	2
Methane, bromochlorodifluoro-, Halon 1211	1750
Methane, bromodifluoro-, Halon 1201	376
Methane, bromotrifluoro-, Halon 1301	6290
Methane, chlorodifluoro-, HCFC-22	1760
Methane, chlorotrifluoro-, CFC-13	13900
Methane, dibromo-	1
Methane, dibromodifluoro-, Halon 1202	231
Methane, dichloro-, HCC-30	9
Methane, dichlorodifluoro-, CFC-12	10200
Methane, dichlorofluoro-, HCFC-21	148
Methane, difluoro-, HFC-32	677
Methane, difluoro(fluoromethoxy)-	617
Methane, difluoro(methoxy)-	144
Methane, fluoro-, HFC-41	116
Methane, fluoro(fluoromethoxy)-	130
Methane, fluoro(methoxy)-	13
Methane, fossil	30.5

Methane, land transformation	30.5
Methane, monochloro-, R-40	12
Methane, tetrachloro-, CFC-10	1730
Methane, tetrafluoro-, CFC-14	6630
Methane, trichlorofluoro-, CFC-11	4660
Methane, trifluoro-, HFC-23	12400
Methane, trifluoro(fluoromethoxy)-	751
Methyl perfluoroisopropyl ether	363
Nitrogen fluoride	16100
Nonanol, 3,3,4,4,5,5,6,6,7,7,8,8,9,9,9-pentadecafluoro-	0.327
Octa deca fluoro octane	7620
Pentafluorobutene-1	0.126
Pentane, 2,3-dihydroperfluoro-, HFC-4310mee	1650
Pentane, perfluoro-	8550
Pentanol, 2,2,3,3,4,4,5,5-octafluorocyclo-	13
Pentanone, 1,1,1,2,2,4,5,5-nonafluoro-4-(trifluoromethyl)-3-	0.0997
Perfluorobut-1-ene	0.0914
Perfluorobut-2-ene	2
Perfluorobuta-1,3-diene	0.00359
Perfluorocyclopentene	2
Perfluorodecalin (mixed)	7190
Perfluorodecalin (trans)	6290
Perfluoroheptane	7820
Perfluoropropene	0.07
PFPME	9710
Propanal, 3,3,3-trifluoro-	0.0108
Propane, 1-ethoxy-1,1,2,2,3,3,3-heptafluoro	61
Propane, 1-ethoxy-1,1,2,3,3,3-hexafluoro-	23
Propane, 1,1,1-trifluoro-, HFC-263fb	76
Propane, 1,1,1,2,2-pentafluoro-, HFC-245cb	4620
Propane, 1,1,1,2,2,3-hexafluoro-, HFC-236cb	1210
Propane, 1,1,1,2,2,3,3-heptafluoro-, HFC-227ca	2640
Propane, 1,1,1,2,2,3,3-heptafluoro-3-(1,2,2-tetrafluoroethoxy)-	6490
Propane, 1,1,1,2,3-pentafluoro-, HFC-245eb	290
Propane, 1,1,1,2,3,3-hexafluoro-, HFC-236ea	1330
Propane, 1,1,1,2,3,3-hexafluoro-3-(trifluoromethoxy)-, HFE-329me3	4550
Propane, 1,1,1,2,3,3,3-heptafluoro-, HFC-227ea	3350
Propane, 1,1,1,3,3-pentafluoro-, HFC-245fa	858
Propane, 1,1,1,3,3,3-hexafluoro-, HCFC-236fa	8060
Propane, 1,1,1,3,3,3-Hexafluoro-2-(difluoromethoxy)	2620

Propane, 1,1,1,3,3,3-hexafluoro-2-(fluoromethoxy)-	216
Propane, 1,1,1,3,3,3-hexafluoro-2-methoxy-(9CI)	14
Propane, 1,1,2,2-tetrafluoro-3-methoxy-	0.525
Propane, 1,1,2,2,3-pentafluoro-, HFC-245ca	716
Propane, 1,1,2,3,3-pentafluoro-, HFC-245ea	235
Propane, 1,3-dichloro-1,1,2,2,3-pentafluoro-, HCFC-225cb	525
Propane, 2,2-difluoro-, HFC-272ca	144
Propane, 3,3-dichloro-1,1,1,2,2-pentafluoro-, HCFC-225ca	127
Propane, perfluoro-	8900
Propane, perfluorocyclo-	9200
Propane,1,1,1,2,2,3,3-heptafluoro-3-methoxy-, HFE-347mcc3 (HFE-7000)	530
Propanol, 2,2,3,3-tetrafluoro-1-	13
Propanol, 3,3,3-trifluoro-1-	0.39
Propanol, pentafluoro-1-	19
Sulfur hexafluoride	23500
Sulfuryl fluoride	4090
Tetrafluoroethylene	0.00292
trans-1,3,3,3-Tetrafluoropropene	0.953
Trifluorobutanol	0.0189
Trifluoroethyl acetate	1
Trifluoromethylsulfur pentafluoride	17400
Trifluoropropene, HFC-1243zf	0.149
Vinylfluoride	65
Carbon dioxide, to soil or biomass stock	-1

Table 2 Characterization factors for substances contributing to emissions of biogenic CO₂-equivalents. The unit is kg CO₂-eq./kg substance.

Substances	Characterization factor
Carbon dioxide, biogenic	1

Comment: The Greenhouse Gas Protocol method has been developed especially for the Road Testing process of the WRI/WBCSD, which aims to test the usability of the draft Greenhouse Gas Protocol carbon footprint standards. See <http://www.ghgprotocol.org/> for the latest version of the standard.

The characterisation factors per substance are identical to the IPCC 2007 GWP (100a) method in SimaPro. The only difference is that carbon uptake and biogenic carbon emissions are included in this method and that a distinction is made between:

1. Fossil based carbon (carbon originating from fossil fuels)

2. Biogenic carbon (carbon originating from biogenic sources such as plants and trees)
3. Carbon from Land transformation (direct impacts)
4. Carbon uptake (CO₂ that is stored in plants and trees as they grow)

The draft standards require fossil and biogenic carbon to be report separately. Reporting of carbon caused by direct land use change is currently defined as optional, depending on the product category while reporting of carbon uptake is not required.

Data Limitations:

Currently only the ecoinvent datasets specify carbon in these four sub categories. If you use other data, eg. from the Input Output libraries, you will not get a correct specification of biogenic carbon, carbon uptake and land use related carbon. This is due to the different data collection strategies used in these libraries. In the process contribution tab in the results section you can see the relative share of the contribution of each process.

Of course you should specify the four sub category emissions in the data you enter your self to obtain a correct split in the results.

Please note that the Road Testing process ends in 2010, and that the current method may not be suitable for the final version of the WRI/WBCSD methods.

Produced: February 2010 by MJ Goedkoop, PRé Consultants bv.

Adaptation (February 2011, v1.01):

- Weighting factor for carbon uptake was changed to -1.

Other adaptations (November 2016, version 1.02):

- Characterisation factors were updated according to IPCC 2013.
- Factors for Methane, Methane, biogenic and Methane, fossil were implemented according to Munoz and Schmidt (2016)*.
- Methane, biogenic as 27.75 kg CO₂eq/kg CH₄ (28 + 2.5 for correction of methane degradation to carbon dioxide - 2.75 for correction of not characterized carbon dioxide uptake)
- Methane, fossil and Methane as 30.5 kg CO₂eq/kg CH₄ (28 + 2.5 for correction of methane degradation to carbon dioxide)
- For substances, which in the IPCC report have a factor "<1", characterization factors from Hodnebrog et al. (2013)** are applied.
- 7 new substances were added: HG-02; HG-03; Ether, i-nonafluorobutane ethyl-, HFE569sf2 (i-HFE-7200); Ether, n-nonafluorobutane ethyl-, HFE569sf2 (n-HFE-7200); 1-Propanol, i-3,3,3-trifluoro-2,2-bis(trifluoromethyl)-, i-HFE-7100; 1-Propanol, n-3,3,3-trifluoro-2,2-bis(trifluoromethyl)-, n-HFE-7100 and Decane, 1,1,...,15,15-eicosafluoro-2,5,8,11,14-

Pentaoxapenta- This name is abbreviated, the full name is: Decane, 1,1,3,3,4,4,6,6,7,7,9,9,10,10,12,12,13,13,15,15-eicosafuoro-2,5,8,11,14-Pentaoxapenta- Carbon dioxide, to soil or biomass stock (emission to soil) is included due to a change in the modelling of land tenure in Ecoinvent.

*Munoz, I. and Schmidt, J.H. (2016), Methane oxidation, biogenic carbon, and the IPCC's emission metrics. Proposal for a consistent greenhouse-gas accounting. The International Journal of Life Cycle Assessment, 21:1069-1075.

**Hodnebrog, Ø., M. Etminan, J. S. Fuglestvedt, G. Marston, G. Myhre, C. J. Nielsen, K. P. Shine, and T. J. Wallington (2013), Global warming potentials and radiative efficiencies of halocarbons and related compounds: A comprehensive review. Rev. Geophys., 51, 300-378, doi:10.1002/rog.20013. Spreadsheet: <http://folk.uio.no/oivinho/halocarbonmetrics/>

As stated on page 120 of the Corporate Value Chain (Scope 3) Accounting and Reporting Standard, a public GHG emissions report should include, when applicable, the following additional information:

- Emissions data further subdivided where this adds relevancy and transparency (e.g., by business unit, facility, country, source type, activity type, etc.)
- Emissions data further disaggregated within scope 3 categories where this adds relevance and transparency (e.g., reporting by different types of purchased materials within category 1, or different types of sold products within category 11)
- Emissions from scope 3 activities not included in the list of scope 3 categories (e.g., transportation, of attendees to/from conferences/events), reported separately (e.g., in an "other" scope 3 category)
- Emissions of GHGs reported in metric tons of each individual gas
- Emissions of any GHGs other than CO₂, CH₄, N₂O, HFCs, PFCs, and SF₆ whose 100-year GWP values have been identified by the IPCC to the extent they are emitted in the company's value chain (e.g., CFCs, HCFCs, NF₃, NO_x, etc.) and a list of any additional GHGs included in the inventory
- Historic scope 3 emissions that have previously occurred, reported separately from future scope 3 emissions expected to occur as a result of the reporting company's activities in the reporting year (e.g., from Waste generated in operations, Use of sold products, End-of-life treatment of sold products)
- Qualitative information about emission sources not quantified

- Information on any GHG sequestration or removals, reported separately from scope 1, scope 2 and scope 3 emissions
- Information on project-based GHG reductions calculated using the project method (e.g., using the *GHG Protocol for Project Accounting*), reported separately from scope 1, scope 2, and scope 3 emissions
- Quantitative assessments of data quality
- Information on inventory uncertainty (e.g., information on the causes and magnitude of uncertainties in emission estimates) and an outline of policies in place to improve inventory quality
- The type of assurance performed (first or third party), the relevant competencies of the assurance provider(s), and the opinion issued by the assurance provider
- Relevant performance indicators and intensity ratios
- Information on the company's GHG management and reduction activities, including scope 3 reduction targets, supplier engagement strategies, product GHG reduction initiatives, etc.
- Information on supplier/partner engagement and performance
- Information on product performance
- A description of performance measured against international and external benchmark
- Information on purchases of GHG reduction instruments, such as emissions allowances and offsets from outside the inventory boundary
- Information on reductions at sources inside the inventory boundary that have been sold/transferred as offsets to a third party
- Information on any contractual provisions addressing GHG-related risks or obligations
- Information on the causes of emissions changes that did not trigger a scope 3 base year emissions recalculation
- GHG emissions data for all years between the scope 3 base year and the reporting year (including details of and reasons for recalculations, if appropriate)
- Additional explanations to provide context to the data