BIOGRACE

Harmonised Calculations of Biofuel Greenhouse Gas Emissions in Europe

The BioGrace Excel GHG calculation tool - Basics

Horst Fehrenbach
IFEU
Public workshop Heidelberg
April 14, 2011

Contents

1. Steps from cultivation to filling station
2. Use individual input numbers

3. Navigate through tool
4. Standard values
5. Define own standard values
6. Inconsistent use of global warming potentials

Demonstrated in Excel Spreadsheet vs.3

Steps from cultivation to filling station

$$E = e_{ec} + e_l + e_p + e_{td} + e_u - e_{sca} - e_{ccs} - e_{ccr} - e_{ee},$$

e_{ee}: combined with **e_p**

$ee_{ccs/ccr}$: technology not in place

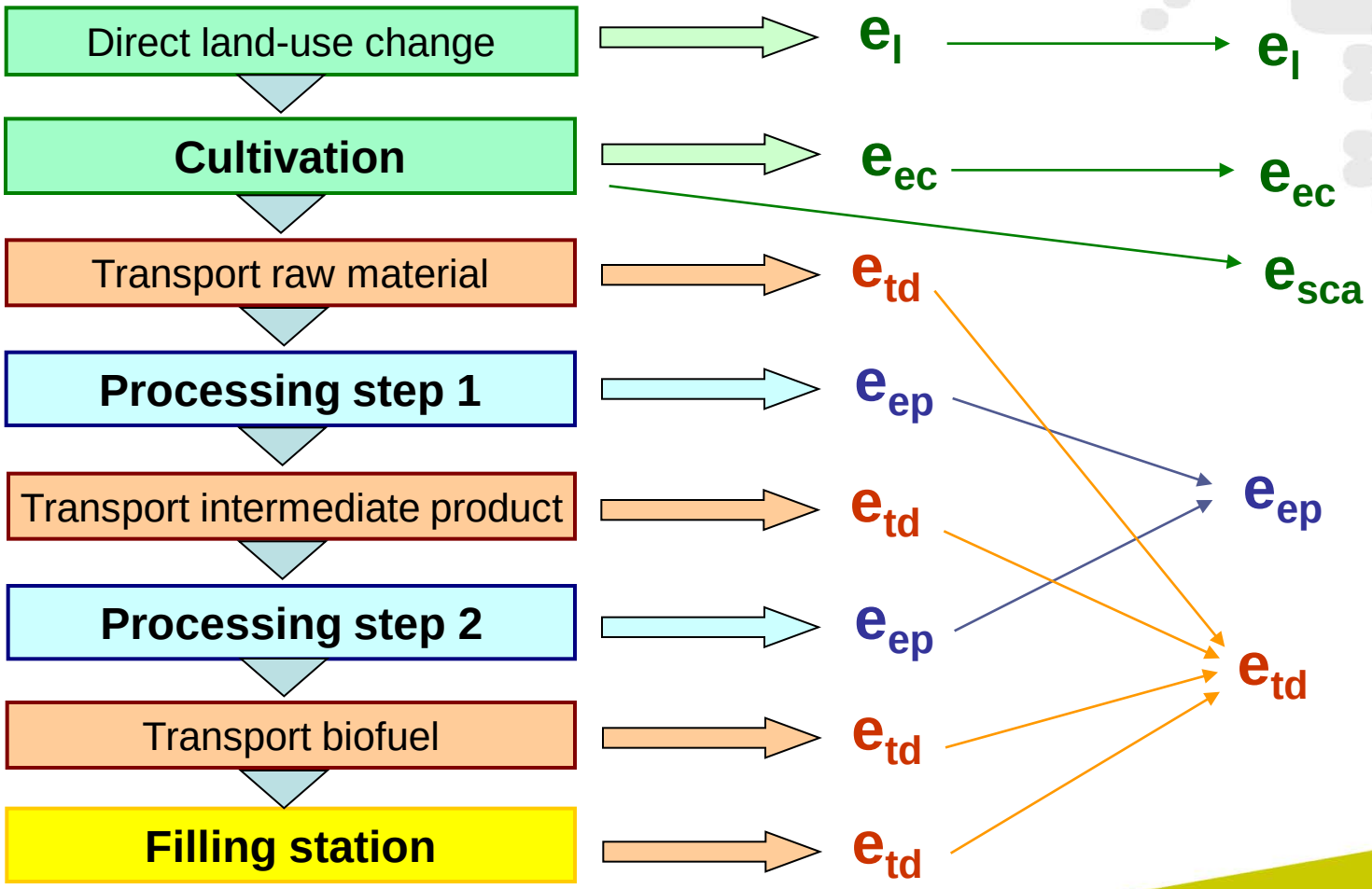
e_{sca}: methodology still under discussion

e_u: maybe relevant for biogas pathways

e_l: following the decision 2010/335/EU

e_{ec}, e_p, e_{td} = basic „disaggregated default values“

Steps from cultivation to filling station



Steps from cultivation to filling station

The aggregation on top

Production of FAME from Rapeseed (steam from natural gas boiler)

Overview Results

All results in g $CO_{2,eq}$ / MJ_{FAME}	Non- allocated results	Allocation factor	Allocated results	Total	Default values RED Annex V.D
Cultivation e_{ec}				28,9	29
Cultivation of rapeseed	48,63	58,6%	**28,49**		28,51
Rapeseed drying	0,72	58,6%	**0,42**		0,42
Processing e_p				21,7	22
Extraction of oil	6,53	58,6%	**3,83**		3,82
Refining of vegetable oil	1,06	95,7%	**1,02**		17,88
Esterification	17,61	95,7%	**16,84**		
Transport e_{td}				1,4	1
Transport of rapeseed	0,30	58,6%	**0,17**		0,17
Transport of FAME	0,82	100%	**0,82**		0,82
Filling station	0,44	100%	**0,44**		0,44
Land use change e_l	**0,0**	58,6%	**0,0**	**0,0**	0
$e_{sca} + e_{ccr} + e_{ccs}$	**0,0**	100%	**0,0**	**0,0**	0
Totals	**76,1**			**52,0**	**52**

Cultivation e_{ec}

Cultivation of rapeseed			Quantity of product	Calculated emissions			
Yield			**Yield**	**Emissions per MJ FAME**			
Rapeseed	3.113	kg ha^{-1} $year^{-1}$	73.975 $MJ_{Rapeseed}$ ha^{-1} $year^{-1}$	g CO_2	g CH_4	g N_2O	g $CO_{2,eq}$
Moisture content	10,0%		1,000 MJ / $MJ_{Rapeseed, input}$				
By-product Straw	n/a	kg ha^{-1} $year^{-1}$	0,073 $kg_{Rapeseed}/MJ_{FAME}$				
Energy consumption							
Diesel	2.963	MJ ha^{-1} $year^{-1}$		6,07	0,00	0,00	6,07
Agro chemicals							
N-fertiliser (kg N)	137,4	kg N ha^{-1} $year^{-1}$		9,08	0,03	0,03	19,00
CaO-fertiliser (kg CaO)	19,0	kg CaO ha^{-1} $year^{-1}$		0,05	0,00	0,00	0,06
K_2O-fertiliser (kg K_2O)	49,5	kg K_2O ha^{-1} $year^{-1}$		0,62	0,00	0,00	0,67
P_2O_5-fertiliser (kg P_2O_5)	33,7	kg P_2O_5 ha^{-1} $year^{-1}$		0,76	0,00	0,00	0,80
Pesticides	1,2	kg ha^{-1} $year^{-1}$		0,28	0,00	0,00	0,32
Seeding material							
Seeds- rapeseed	6	kg ha^{-1} $year^{-1}$		0,06	0,00	0,00	0,10
Field N_2O emissions	3,10	kg ha^{-1} $year^{-1}$		0,00	0,00	0,07	21,61
			Total	**16,92**	**0,03**	**0,10**	**48,63**
			Result		**g $CO_{2,eq}$ / MJ_{FAME}**		**48,63**

fill in actual data

fill in actual data

Yield		
Rapeseed	3.113	kg ha^{-1} $year^{-1}$
Moisture content	10,0%	
By-product Straw	n/a	kg ha^{-1} $year^{-1}$
Energy consumption		
Diesel	2.963	MJ ha^{-1} $year^{-1}$
Agro chemicals		
N-fertiliser (kg N)	137,4	kg N ha^{-1} $year^{-1}$
CaO-fertiliser (kg CaO)	19,0	kg CaO ha^{-1} $year^{-1}$
K_2O-fertiliser (kg K_2O)	49,5	kg K_2O ha^{-1} $year^{-1}$
P_2O_5-fertiliser (kg P_2O_5)	33,7	kg P_2O_5 ha^{-1} $year^{-1}$
Pesticides	1,2	kg ha^{-1} $year^{-1}$
Seeding material		
Seeds- rapeseed	6	kg ha^{-1} $year^{-1}$
Field N_2O emissions	3,10	kg ha^{-1} $year^{-1}$

In version 3 and 4: still fixed value. In version 5: calculation sheet

Cultivation e_{ec}

Cultivation of rapeseed			Quantity of product	Calculated emissions			
Yield			**Yield**	**Emissions per MJ FAME**			
Rapeseed	3.113	kg ha^{-1} $year^{-1}$	73.975 $MJ_{Rapeseed}$ ha^{-1} $year^{-1}$	g CO_2	g CH_4	g N_2O	g $CO_{2,eq}$
Moisture content	10,0%		1,000 MJ / $MJ_{Rapeseed, input}$				
By-product Straw	n/a	kg ha^{-1} $year^{-1}$	0,073 $kg_{Rapeseed}/MJ_{FAME}$				
Energy consumption							
Diesel	2.963	MJ ha^{-1} $year^{-1}$		6,07	0,00	0,00	6,07
Agro chemicals							
N-fertiliser (kg N)	137,4	kg N ha^{-1} $year^{-1}$		9,08	0,03	0,03	19,00
CaO-fertiliser (kg CaO)	19,0	kg CaO ha^{-1} $year^{-1}$		0,05	0,00	0,00	0,06
K_2O-fertiliser (kg K_2O)	49,5	kg K_2O ha^{-1} $year^{-1}$		0,62	0,00	0,00	0,67
P_2O_5-fertiliser (kg P_2O_5)	33,7	kg P_2O_5 ha^{-1} $year^{-1}$		0,76	0,00	0,00	0,80
Pesticides	1,2	kg ha^{-1} $year^{-1}$		0,28	0,00	0,00	0,32
Seeding material							
Seeds- rapeseed	6	kg ha^{-1} $year^{-1}$		0,06	0,00	0,00	0,10
Field N_2O emissions	3,10	kg ha^{-1} $year^{-1}$		0,00	0,00	0,07	21,61
			Total	**16,92**	**0,03**	**0,10**	**48,63**
			Result		g $CO_{2,eq}$ / MJ_{FAME}		48,63

conversion factors yield related

fill in actual data

Quantity of product	
Yield	
73.975	$MJ_{Rapeseed}\ ha^{-1}\ year^{-1}$
1,000	$MJ / MJ_{Rapeseed,\ input}$
0,073	$kg_{Rapeseed}/MJ_{FAME}$

yield related conversion factors raw material per final biofuel

values as a function of input values and/or of the chain

Cultivation e_{ec}

multiplying input values with "standard values"

Cultivation of rapeseed			Quantity of product	Calculated emissions			
				Emissions per MJ FAME			
				g CO_2	g CH_4	g N_2O	g $CO_{2,eq}$
Yield			**Yield**				
Rapeseed	3.113	kg ha^{-1} $year^{-1}$	73.975 $MJ_{Rapeseed}$ ha^{-1} $year^{-1}$				
Moisture content	10,0%		1,000 MJ / $MJ_{Rapeseed, input}$				
By-product Straw	n/a	kg ha^{-1} $year^{-1}$	0,073 $kg_{Rapeseed}/MJ_{FAME}$				
Energy consumption							
Diesel	2.963	MJ ha^{-1} $year^{-1}$		6,07	0,00	0,00	6,07
Agro chemicals							
N-fertiliser (kg N)	137,4	kg N ha^{-1} $year^{-1}$		9,08	0,03	0,03	19,00
CaO-fertiliser (kg CaO)	19,0	kg CaO ha^{-1} $year^{-1}$		0,05	0,00	0,00	0,06
K_2O-fertiliser (kg K_2O)	49,5	kg K_2O ha^{-1} $year^{-1}$		0,62	0,00	0,00	0,67
P_2O_5-fertiliser (kg P_2O_5)	33,7	kg P_2O_5 ha^{-1} $year^{-1}$		0,76	0,00	0,00	0,80
Pesticides	1,2	kg ha^{-1} $year^{-1}$		0,28	0,00	0,00	0,32
Seeding material							
Seeds- rapeseed	6	kg ha^{-1} $year^{-1}$		0,06	0,00	0,00	0,10
Field N_2O emissions	3,10	kg ha^{-1} $year^{-1}$		0,00	0,00	0,07	21,61
				Total	**16,92**	**0,03**	**0,10**	**48,63**
				Result		**g $CO_{2,eq}$ / MJ_{FAME}**	**48,63**

conversion factors yield related

fill in actual data

Cultivation e_{ec}

Results related to raw material or acreage

Cultivation of rapeseed		Info	
Yield		**per kg rapeseed**	**per ha, year**
Rapeseed	g $CO_{2,\ eq}$	g $CO_{2,\ eq}$	kg $CO_{2,\ eq}$
Moisture content			
By-product Straw			
Energy consumption			
Diesel	6,07	83,40	259,7
Agro chemicals			
N-fertiliser (kg N)	19,00	261,19	813,2
CaO-fertiliser (kg CaO)	0,06	0,79	2,5
K_2O-fertiliser (kg K_2O)	0,67	9,20	28,6
P_2O_5-fertiliser (kg P_2O_5)	0,80	10,96	34,1
Pesticides	0,32	4,36	13,6
Seeding material			
Seeds- rapeseed	0,10	1,41	4,4
Field N_2O emissions	21,61	296,99	924,7
	48,63	**668,31**	**2080,7**
	48,63		

Processing e_p Step 1, oil extraction

Extraction of oil			Quantity of product		Calculated emissions			
					Emissions per MJ FAME			
Yield					g CO_2	g CH_4	g N_2O	g $CO_{2,eq}$
Crude vegetable oil	0,6125	MJ_{Oil} / $MJ_{Rapeseed}$	44.861	MJ_{Oil} ha^{-1} $year^{-1}$				
By-product Rapeseed cake	0,3875	$MJ_{Rapeseed\ cake}$ / $MJ_{Rapeseed}$	0,606	MJ / $MJ_{Rapeseed,\ input}$				
			0,029	kg_{Oil} / MJ_{FAME}				
Energy consumption								
Electricity EU mix MV	0,0118	MJ / MJ_{Oil}			1,47	0,00	0,00	1,58
Steam (from NG boiler)	0,0557	MJ / MJ_{Oil}						
NG Boiler					Emissions from NG boiler			
CH_4 and N_2O emissions from NG boiler					0,00	0,00	0,00	0,02
Natural gas input / MJ steam	1,111	MJ / MJ_{Steam}						
Natural gas (4000 km, EU mix	0,062	MJ / MJ_{Oil}			4,08	0,01	0,00	4,41
Electricity input / MJ steam	0,020	MJ / MJ_{Steam}						
Electricity EU mix MV	0,001	MJ / MJ_{Oil}			0,14	0,00	0,00	0,15
Chemicals								
n-Hexane	0,0043	MJ / MJ_{Oil}			0,36	0,00	0,00	0,37
				Total	**6,06**	**0,02**	**0,00**	**6,53**
				Result	**g $CO_{2,eq}$ / MJ_{FAME}**			**6,53**

fill in actual data

Transport e_{td} of FAME

Transport of FAME	to and from depot			Quantity of product		Calculated emissions			
	FAME	1,000	MJ_{FAME} / MJ_{FAME}	42790,9	MJ_{FAME} ha^{-1} $year^{-1}$	Emissions per MJ FAME			
				0,578	MJ / $MJ_{Rapeseed, input}$	g CO_2	g CH_4	g N_2O	g $CO_{2, eq}$
	Transport per								
	Truck for liquids (Diesel)	300	km	0,0047	ton km / $MJ_{Rapeseed, input}$	0,71	0,00	0,00	**0,71**
	Fuel	Diesel							
	Energy cons. depot								
	Electricity EU mix LV	0,00084	MJ / MJ_{FAME}			0,10	0,00	0,00	**0,11**
					Result	g $CO_{2,eq}$ / MJ_{FAME}			0,8225

fill in actual data

Filling station			Quantity of product					
	Yield	1,000	MJ_{FAME} / MJ_{FAME}	42790,9	MJ_{FAME} ha^{-1} $year^{-1}$	Emissions per MJ FAME			
				0,578	MJ / $MJ_{Rapeseed, input}$	g CO_2	g CH_4	g N_2O	g $CO_{2, eq}$
	Energy consumption								
	Electricity EU mix LV	0,0034	MJ / MJ_{FAME}			0,41	0,00	0,00	**0,44**
					Result	g $CO_{2,eq}$ / MJ_{FAME}			0,44

- Include new process steps
- Set up completely new biofuel production chains

Afternoon session "Practical calculation"

- Navigate through tool
- Standard values
- Define own standard values
- Inconsistent use of global warming potentials

BioGrace GHG calculations – version 3 - Public.xls

BIOGRACE

Harmonised Calculations of Biofuel Greenhouse Gas Emissions in Europe

The BioGrace Excel GHG calculation tool – Other parts

Horst Fehrenbach
IFEU
Public workshop Heidelberg
April 14, 2011

Contents

Introduction

$$E = e_{ec} + \boxed{e_l} + e_p + e_{td} + e_u - \boxed{e_{sca}} - \boxed{e_{ccs} - e_{ccr}} - e_{ee},$$

$ee_{ccs/ccr}$: CO_2 capture, storage or replacement

e_{sca}: Carbon storage from improved agricultural management

e_l: Land use change, following the decision 2010/335/EU

Introduction

Direct land-use change, Improved man. practices → e_l, e_{sca}

Cultivation

Transport raw material

Processing step 1

Transport intermediate product

Processing step 2

Storage, replacement → e_{ccs}, e_{ccr}

Transport biofuel

Filling station

Contents

Land Use Change

General principles :

1. Annex V of the RED gives the general calculation guidelines (part C, point 7):

$$e_l = (CS_R - CS_A) \times 3{,}664 \times 1/20 \times 1/P - e_B \ (1)$$

2. Calculation rules are explained in the following the decision 2010/335/EU: *Commission Decision of 10 June 2010 on guidelines for the calculation of land use carbon stocks for the purpose of Annex V of Directive 2009/28/EC.*

   This communication gives:

   - Consistent representation of land carbon stocks
   - Calculation rules
   - Default data for applying this formula (tables)

Land Use Change

General principles :

Two types of calculation are possible :

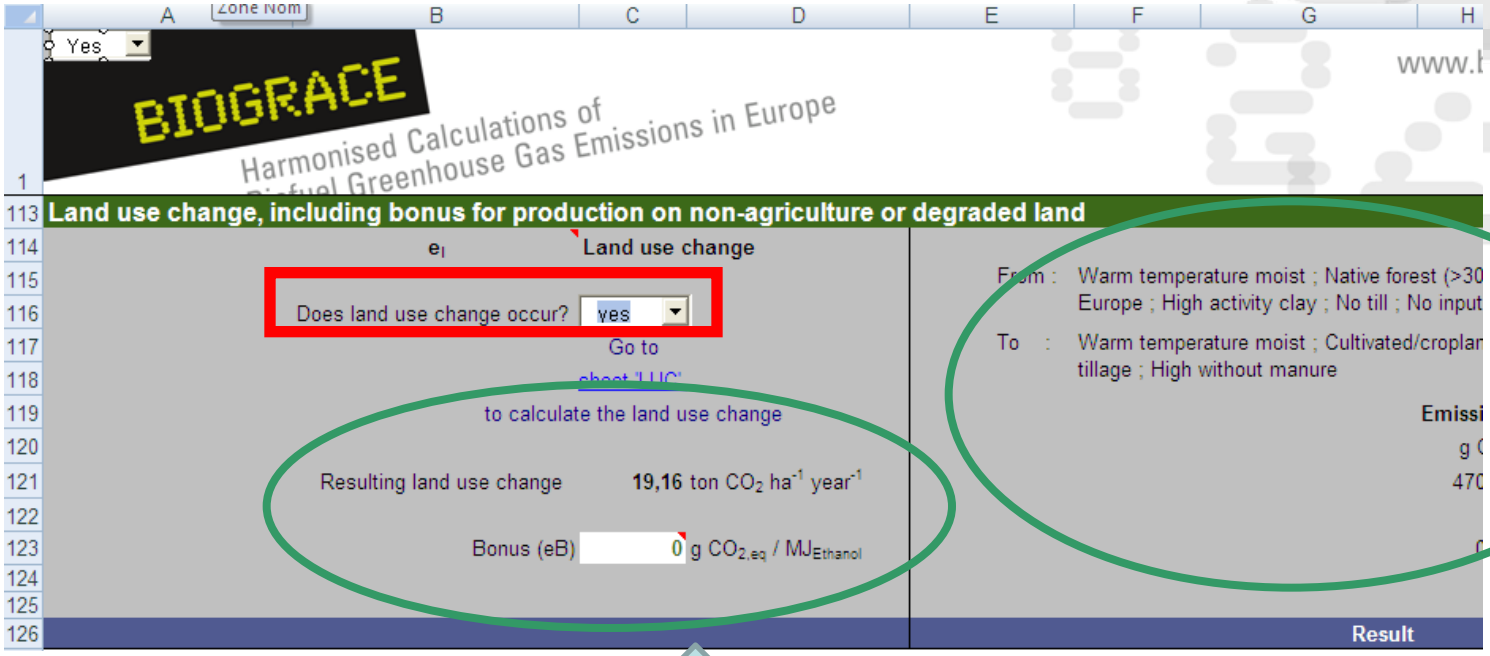
1. *Calculation using default value*

$$CS_i = C_{VEG} + SOC_{ST} * F_{LU} * F_{MG} * F_I$$

2. *Calculation using actual value for C_{VEG} and Soil Organic Carbon (SOC).*

$$CS_i = C_{VEG} + SOC$$

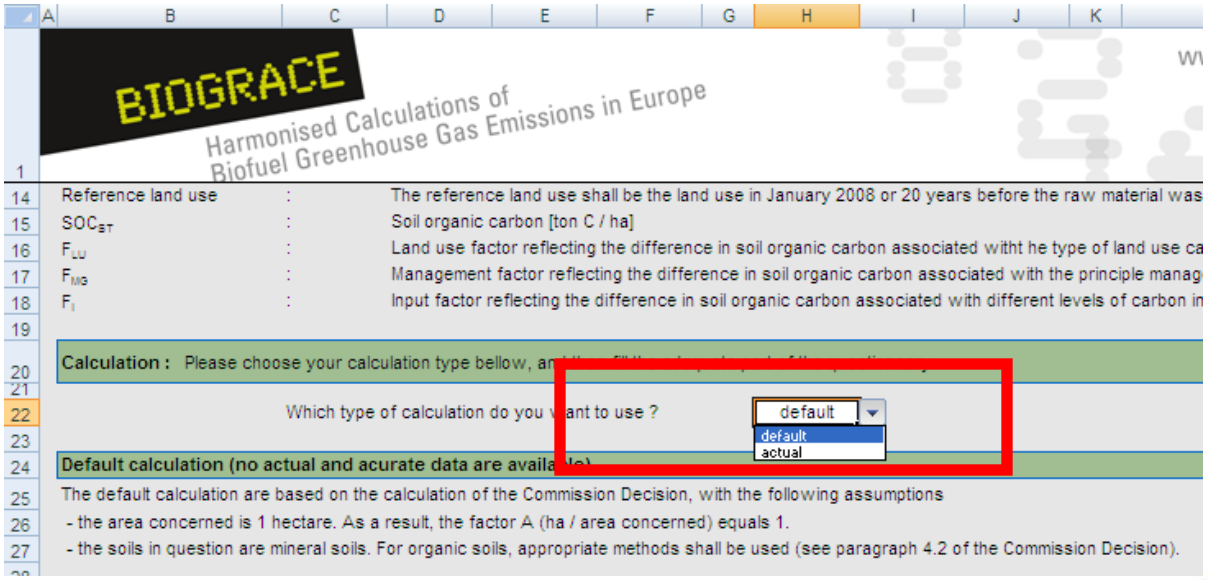
Step 1 : declare LUC in your pathway



Text appear

Step 2 : Go to the LUC excel sheet and read through this sheet. Get the Commission Decision 2010/335/EU with you.

Step 3 : Choose the type of calculation : default or actual and fill the appropriate white cells.



Step 4 (default calculation) : use EC decision to fill out data

CS_A and CS_R are calculated with the following equation: $CS_i = C_{VEG} + SOC_{ST} * F_{LU} * F_{MG} * F_I$

	Actual land use		Reference land use		
Climate region	Warm temperature moist		Warm temperature moist		Determine using paragraph 6.1 of Commission Decisio
Vegetation/crop (land use)	Cultivated/cropland		Native forest (>30% canopy cover)		Determine using paragraph 6.2 of Commission Decisio
Above and below ground vegetation					
Ecological zone (if relevant)	-		Oceanic forest		Determine using table 3 of Commission Decision
Continent (if relevant)	-		Europe		Determine using table 3 of Commission Decision
C_{VEG}	0	ton C / ha	84	ton C / ha	Calculate value according to Chapter 5, or look up val
Carbon stock in mineral soil					
Climate region	Warm temperature moist		Warm temperature moist		Loop up in Table 1 of Commission Decision, using clim
Soil type	High activity clay		High activity clay		Look up in Tables 2 - 8 of Commission Decision
Soil management	Full-tillage		No till		Look up in Tables 2 - 8 of Commission Decision
Input	High without manure		No input		Look up in Tables 2 - 8 of Commission Decision
SOC_{ST}	88	ton C / ha	88	ton C / ha	
F_{LU}	0,69		1		
F_{MG}	1		n/a		
F_I	1,11		n/a		

17.6.2010 EN Official Journal of the European Union L 151/27

7.1. **Cropland**

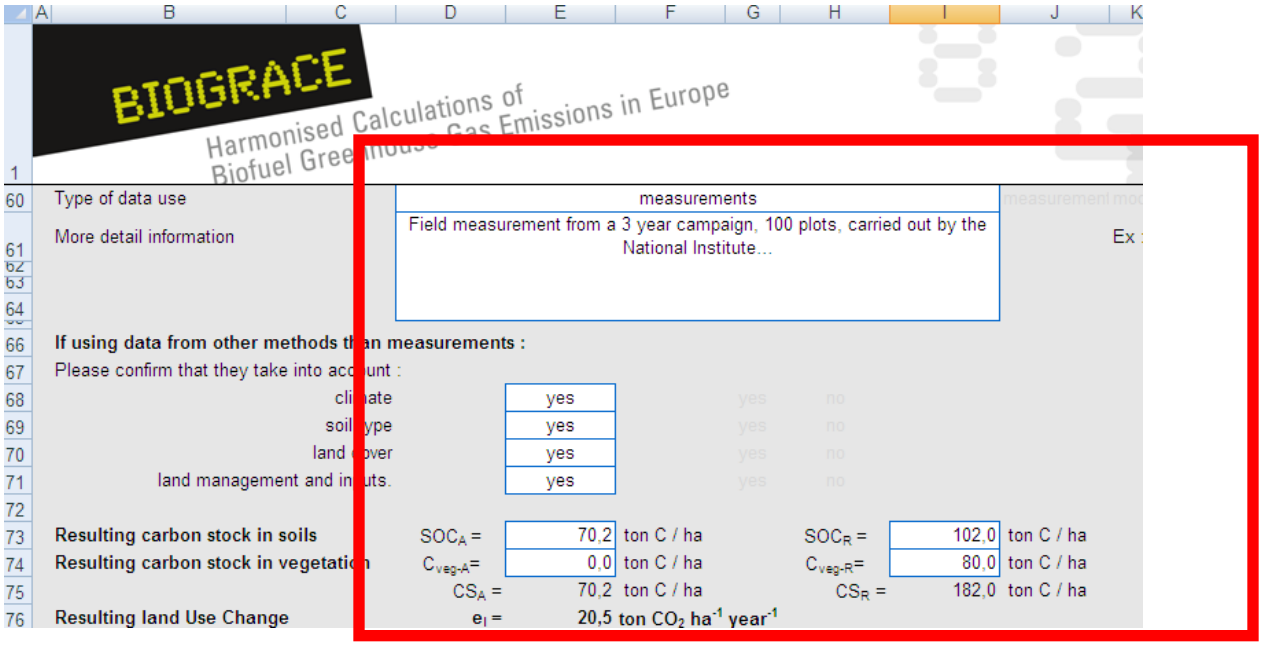
Table 2

Factors for cropland

Climate region	Land use (F_{LU})	Management (F_{MG})	Input (F_I)	F_{LU}	F_{MG}	F_I
Temperate/Boreal, dry	Cultivated	Full-tillage	Low	0,8	1	0,95
			Medium	0,8	1	1
			High with manure	0,8	1	1,37
			High without manure	0,8	1	1,04
		Reduced tillage	Low	0,8	1,02	0,95
			Medium	0,8	1,02	1

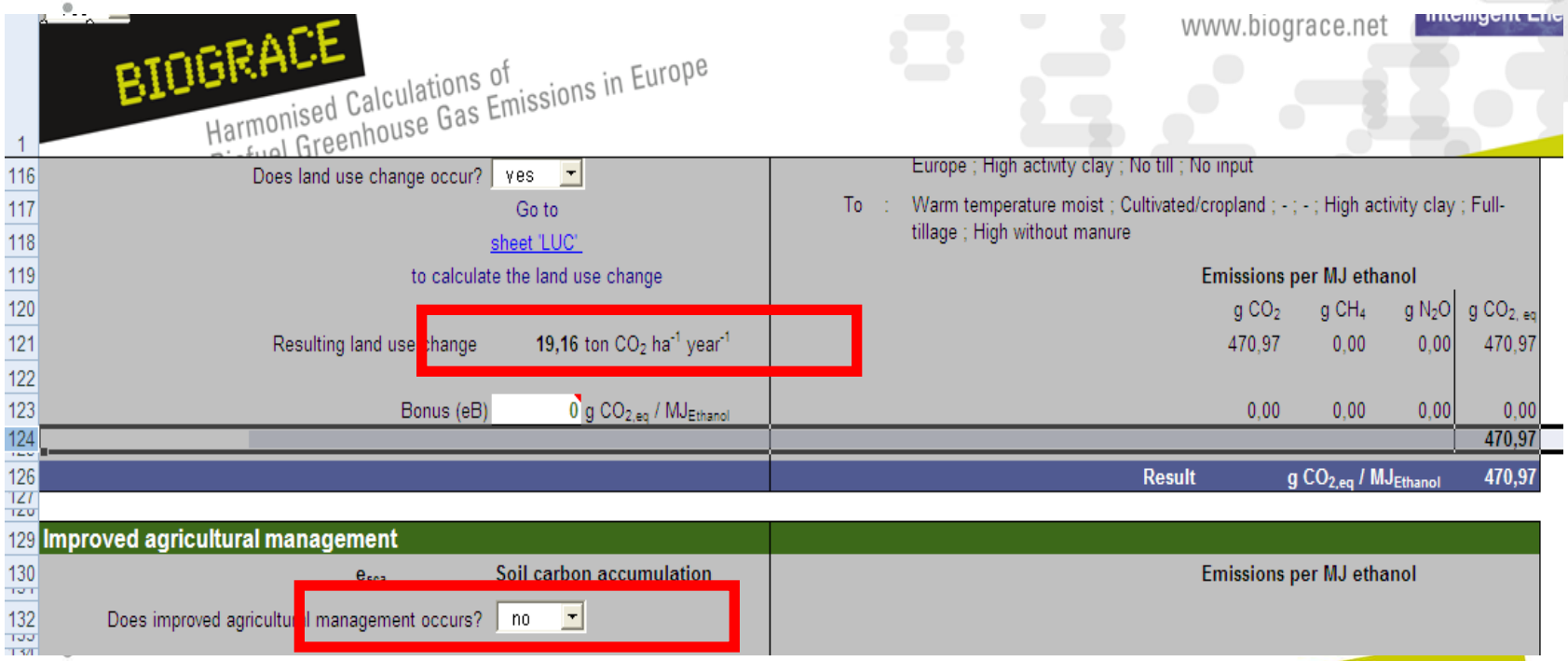
Resulting carbon stock	CS_A =	67,4	ton C / ha	CS_R = 172,0 ton C / ha
Resulting LUC	e_i =	19,16	ton eq. CO_2 / ha / an	

Step 4 (actual calculation) : mind filling detailed information on the sources of the SOC data used.



60	Type of data use		measurements				
61	More detail information		Field measurement from a 3 year campaign, 100 plots, carried out by the National Institute...				
66	**If using data from other methods than measurements :**						
67	Please confirm that they take into account :						
68	climate		yes				
69	soil type		yes				
70	land cover		yes				
71	land management and inputs.		yes				
73	**Resulting carbon stock in soils**	SOC_A =	70,2	ton C / ha	SOC_R =	102,0	ton C / ha
74	**Resulting carbon stock in vegetation**	C_{veg-A}=	0,0	ton C / ha	C_{veg-R}=	80,0	ton C / ha
75		CS_A =	70,2	ton C / ha	CS_R =	182,0	ton C / ha
76	**Resulting land Use Change**	e_l =	20,5	ton CO_2 ha^{-1} $year^{-1}$			

Step 5 : Check in the biofuel pathway that the LUC value is there. Please, also check that no Improved agricultural management is declared.



1	BIOGRACE Harmonised Calculations of Biofuel Greenhouse Gas Emissions in Europe					www.biograce.net
116	Does land use change occur? yes	Europe ; High activity clay ; No till ; No input				
117	Go to	To : Warm temperature moist ; Cultivated/cropland ; - ; - ; High activity clay ; Full-tillage ; High without manure				
118	sheet 'LUC'					
119	to calculate the land use change	Emissions per MJ ethanol				
120			g CO_2	g CH_4	g N_2O	g $CO_{2,eq}$
121	Resulting land use change 19,16 ton CO_2 ha^{-1} $year^{-1}$		470,97	0,00	0,00	470,97
122						
123	Bonus (eB) 0 g $CO_{2,eq}$ / $MJ_{Ethanol}$		0,00	0,00	0,00	0,00
124						470,97
126		Result	g $CO_{2,eq}$ / $MJ_{Ethanol}$			470,97
129	Improved agricultural management					
130	e_{sca} Soil carbon accumulation	Emissions per MJ ethanol				
132	Does improved agricultural management occurs? no					

e_b bonus for degraded and contaminated lands :

- A specific line exits within the LUC module of each pathway.

- Explanations on how to use are to be taken from the RED

Land use change, including bonus for production on non-agriculture or degraded land

e_l Land use change

Does land use change occur? no

		Emissions per MJ ethanol			
		g CO_2	g CH_4	g N_2O	g $CO_{2\ eq}$
Resulting land use change	0,00 ton CO_2 ha^{-1} $year^{-1}$	0,00	0,00	0,00	0,00

Bonus (eB) 0 g

The bonus of 29 gCO_{2eq}/MJ shall be attributed if evidence is provided that the land:
(a) was not in use for agriculture or any other activity in January 2008; and
(b) falls into one of the following categories:
(i) severely degraded land, including such land that was formerly in agricultural use;
(ii) heavily contaminated land.
The bonus of 29 gCO_{2eq}/MJ shall apply for a period of up to 10 years from the date of conversion of the land to agricultural use, provided that a steady increase in carbon stocks as well as a sizable reduction in erosion phenomena for land falling under (i) are ensured and that soil contamination for land falling under (ii) is reduced.

Improved agricultural management

e_{sca} Soil carbon

Contents

Improved Agricultural Management

1. Annex V of the RED has a specific term for carbon stock accumulation thanks to improved practices, but does not give much more explanations on how to calculate it
2. Calculation rules from the Commission Decision can serve as guidelines for making first level calculations
3. As for LUC, actual data can be used to assess them
4. In the BioGrace tool, an e_{sca} sheet exist to carry out the calculation
5. This sheet is build on the same frame than the LUC sheet
6. Don't declare e_{sca} when LUC are already declared (double counting)

Contents

CO_2 storage or replacement

General principles :

1. Annex V of the RED has specific terms for carbon stock accumulation thanks to improved practices, but does not give much more explanations
2. In the BioGrace tool, two modules exist to declare these technological solutions. The value in g CO_2/MJ has to be added
3. Please, keep track of your calculations for verification requirements

43	CO_2 capture and replacement			
44	e_{ccr}		Emissions per MJ ethanol	
45	0	g $CO_{2,eq}$ / $MJ_{Ethanol}$		0,00
46			Result g $CO_{2,eq}$ / $MJ_{Ethanol}$	0,00
47				
48				
49	CO_2 capture and geological storage			
50	e_{ccs}		Emissions per MJ ethanol	
51	0	g $CO_{2,eq}$ / $MJ_{Ethanol}$		0,00
52			Result g $CO_{2,eq}$ / $MJ_{Ethanol}$	0,00

CO_2 storage or replacement

General principles :

4. Replacement : "*Emission saving from carbon capture and replacement, e_{ccr}, shall be limited to emissions avoided through the capture of CO_2 of which the carbon originates from biomass and which is used to replace fossil-derived CO_2 used in commercial products and services.*"
5. Storage : *"Emission saving from carbon capture and geological storage e_{ccs}, that have not already been accounted for in ep, shall be limited to emissions avoided through the capture and sequestration of emitted CO_2 directly related to the extraction, transport, processing and distribution of fuel."*

Contents

New items in Public version 4

User Manual (or tutorial)

- A detailed tutorial will be provided with the BioGrace tool
- It aims at helping the economic operators to understand and use the BioGrace GHG calculation tool.

User manual for the BioGrace greenhouse gas (GHG) calculation tool

This support document is designed to help the economic operators to understand and use the BioGrace GHG calculation tool. The main questions that arise concerning the tool are presented below, with a link to the appropriate chapter of this user manual.

Functions of the tool	This chapter details the different way of using this tool. You will find what the tool was developed for and what it can possibly do.
How does the tool work?	This chapter explains how the tool is designed and the general principles of the calculations.
How can I use the tool to understand the default values?	The following chapters allow any user to make use of the tool in function of its personal objective.
How can I use the tool to calculate my own actual value?	
How can I create a new pathway with the tool?	

New items in Public version 4

Calculation rules

- Making actual calculations under the RED/FQD requires rules
  - Which input data and standard values are allowed?
  - Cut-off criterion
  - Combination of actual and disaggregated values
- Many of these rules not yet defined
  - More detailed than methodology in RED Annex V.C
  - Some rules given in communications, several are not covered
- BioGrace will make document “calculation rules”
  - To be published as a separate document
  - To be linked to GHG Excel tool
- European Commission will be evaluating rules…
  - … when assessing a voluntary certification scheme after a request for recognition

BIOGRACE
Harmonised Calculations of Biofuel Greenhouse Gas Emissions in Europe

Intelligent Energy Europe

New items in Public version 4

Track changes

- One of the calculation rules:
  - *"Use 'track changes' for verification purposes"*

BIOGRACE
Harmonised Calculations of Biofuel Greenhouse Gas Emissions in Europe

www.biograce.net

Intelligent Energy Europe

About | Directory

Production of Ethanol from Sugarbeet (steam from NG boiler) — Version 4 - Public

Overview Results

All results in g $CO_{2,eq}$ / $MJ_{Ethanol}$	Non- allocated results	Allocation factor	Allocated results	Total	Default values RED Annex V.D
Cultivation e_{ec}				11,3	12
Cultivation of sugarbeet	15,89	71,3%	**11,33**		11,54
Processing e_p				26,4	26
Ethanol plant	37,03	71,3%	**26,40**		26,42
Transport e_{td}				2,3	2
Transport of sugarbeet	1,11	71,3%	**0,79**		0,84
Transport of ethanol	1,10	100%	**1,10**		1,10
Filling station	0,44	100%	**0,44**		0,44
Land use change e_l	**0,0**	71,3%	**0,0**	0,0	0
$e_{sca} + e_{ccr} + e_{ccs}$	**0,0**	100%	**0,0**	0,0	0
Totals	**55,6**			**40,1**	**40**

Allocation factors	
Ethanol plant	
71,3%	to ethanol
28,7%	to Sugar beet pulp

Emission reduction	
Fossil fuel reference (petrol)	
83,8	g $CO_{2,eq}$/MJ
GHG emission reduction	
52%	

Calculations in this Excel sheet……

- ☐ ~~*strictly follow the methodology as given in Directives 2009/28/EC and 2009/30/EC*~~
- ☑ **follow JEC calculations by using GWP values 25 for CH4 and 298 for N2O**

As explained in "About" under "Inconsistent use of GWP's"

When using this GHG calculation tool, **the BioGrace calculation rules must be respected.**
The rules are included in the zip file in which you downloaded this tool. The rules are also available at www.BioGrace.net

Calculation per phase

Track changes: ON

Cultivation of sugarbeet

Yield		
Sugar beet	**70.000**	kg ha^{-1} $year^{-1}$
Moisture content	**75,0%**	

Quantity of product

Yield	
285.250	$MJ_{Sugar\ beet}$ ha^{-1} $year^{-1}$
1,000	MJ / $MJ_{Sugarbeet,\ input}$
0,451	$kg_{Sugarbeet}/MJ_{ethanol}$

Calculated emissions

Emissions per MJ ethanol	g CO_2	g CH_4	g N_2O	g $CO_{2,eq}$

Info

per kg sugarbeet	per ha, year
g $CO_{2,eq}$	kg $CO_{2,eq}$

Contents

New item in Public version 5

Calculation of N_2O field emissions

1. A major contributors to GHG emissions of most of the pathways
2. Default value : N_2O emissions calculated from a model (DNDC, average EU), except some pathways (IPCC Tier 1 for soybeans, palm trees, sugarcane)
3. For new pathways or when modifying the cultivation data from an existing pathways : BioGrace recommends to use IPCC Tier 1 estimation for this emission
4. BioGrace tool aims to provide an Excel sheet for making N_2O calculations

N_2O emissions : fill in few input data

	A	B	C	D	E	F
1	**Calculation of N2O emissions using the IPCC methodology**					
	This sheet calculates the emissions of N2O from the cultivation of the crop					
	The calculations make use of IPCC methodology Tier 1 on the estimation of N_2O emissions from managed soils (1).					
	For some crops (soybeans, sugarcane and palm trees) the additional hypothesis used in JEC calculations have been incorpo					
	In the case of soybeans, the nitrogen content of below ground biomass was considered to be 0.074 kg N/(kg dry matter) ins					
	In the case of sugar cane, N of above ground residues are not calculated using the IPCC methods. Alternatively additions of					
	In the case of palm trees, N of above ground residues are calculated by the JEC considering that 0.22 t dry residues are retu					
	(1) IPCC 2006, 2006 IPCC Guidelines for National Greenhouse Gas Inventories, Prepared by the National Greenhouse Gas Inv					
	Crop data.					
2	Please enter the data for your crop in the blue cel					
3	Crop name	Sugar cane				
4	Crop yield (fresh matter)	1000	kg $_{fm}$/ha			
5	Humidity(%)	45,0%				
6	Crop yield (dry matter)	550	kg $_{dm}$/ha			
7	Straw yield (removed from the field)		kg dm/ha			
8						
9						
	Amount of vignasse applied to the field (by defaul 0.94		kg of vignasse dm / kg sucar cane fm			
2	Amount of filter cake applied to the field (by defau 0.01)		kg of filter cake dm/kg sugar cane fm			
3	N content of vignasse applied to the field (by defa lt 0.36)		kg N / t vignasse			
4	N content of filter cake applied to the field (by def ult 12.5)		kg N / t filter cake			
5						
6	Carbon loss due to land use change	0	t/ha			
	Is the crop irrigated OR is rainfall in rainy season minus potencial					
7	evaporation higher than soil water holding capacit ?	1	yes=1; no=0			

N_2O emissions

29							
30	**Direct N2O emissions from managed soils (Tier1).**						
31	Please enter the N additions in the form of synthetic or organic fertilizer in the blue cells						
32	**N_2O emissions from N inputs: $N_2O\_N_{inputs}$**						
33							
34	F_{SN}			kg N/ha	N in synthetic fertilizer		
35	F_{ON}			kg N/ha	N in organic fertilizer		
36	F_{CR}			0 kg N/ha	N in crop residues		
37	F_{SOM}			0,00 kg N/ha	N mineralized		
38							
39	EF_1		0,01	0,003	0,03		
40							
41							
42							
43							
44							
45		kg N_2O_N/ha				kg N_2O/ha	
46	$N_2O\_N_{N\ inputs}$		0,00	0,00	0,00	0,00	0,00
47							

F_{CR}	N in crop residues		
$AG_{DM(T)}$	0	kg/ha	
$Frac_{Renew(T)}$	1		
$R_{AG(T)}$	0,000		
$N_{AG(T)}$	0		
$Frac_{Remove(T)}$	#DIV/0!		
$R_{BG(T)}$	0,00		
$N_{BG(T)}$	0,000		
F_{CR}	0	kg N/ha	Eq 11.6
	0	kg N/ha	Eq 11.7A

	N_{AG}	slope	intercept	$AG_{DM(T)}$	$(AG_{DM(T)}*100($	$R_{AG(T)}$	$R_{BG-BIO(T)}$	N_{BG}
Sugar beet	0,016	1,07	1,54	2,13	4,87	3,87	0,2	
Wheat	0,006	1,51	0,52	1,35	3,46	2,46	0,24	
Corn	0,006	1,03	0,61	1,18	3,14	2,14	0,22	
Sugar cane				0,00	1,00	0,00		
Rapeseed	0,006	1,09	0,88	1,48	3,69	2,69	0,22	
Sunflower	0,006	1,09	0,88	1,48	3,69	2,69	0,22	
Soybeans	0,008	0,93	1,35	1,86	4,38	3,38	0,19	
Palm	0,011			0,00	1,00	0,00		

N_2O emissions : direct and indirect emissions calculation

$N_2O_{(L)}$-N	Leaching		
F_{SN}	0 kg N/ha		N in synthetic fertilizer
F_{ON}			
F_{CR}			
F_{SOM}			
Frac $_{LEA}$			
EF_5			

$N_2O_{(ATD)}$-N	Volatilization		
F_{SN}	0 kg N/ha		N in synthetic fertilizer
F_{ON}	0 kg N/ha		N in organic fertilizer
Frac $_{GASM}$	0,2	0,05	0,5
Frac $_{GASF}$	0,1	0,03	0,3
EF_4	0,01	0,002	0,05
	kg N2O_N/ha		
$N2O_{(ATD)}$-N	0,00	0,000	0,000

Indirect N_2O emissions from managed soils (Tier1)				
	kg N_2O_N/ha			kg N_2O/ha
N_2O from atmospheric deposition of N	0,00	0,00	0,00	0,00
$N_2O_{(L)}$-N	0,00	0,00	0,00	0,00

Direct + Indirect N_2O emissions from managed soils (Tier1)							
	kg N_2O_N			kg N_2O			
Total N_2O emissions	0,01	0,00	0,00	0,01	0,00	0,00	per ha
	0,01	0,00	0,00	0,02	0,00	0,00	per kg
	0,0005	0,0000	0,0000	0,00	0,00	0,00	per MJ

Contents

BioGrace as a voluntary scheme

Observations:

- Current voluntary cert. schemes do not include GHG tool
  - ISSC, REDcert, NTA8080, RSPO, RTRS, Bonsucro (BSI)
- European Commission only allows use of GHG tool if it is recognised as a voluntary cert. scheme
- To our knowledge no GHG tools have been send to Commission for recognition
  - Some schemes will be send in, eg. National GHG tools
  - Information on actual developments is scarce
- GHG tool can be used as “add-on” to existing schemes

BioGrace will submit GHG tool to EC for recognition as a voluntary scheme

BioGrace as a voluntary scheme

- BioGrace voluntary scheme will consist of a zip file with
  1. BioGrace Excel GHG tool
  2. BioGrace calculation rules
  3. BioGrace user manual
- BioGrace scheme does not contain requirements on audits and mass balance
  - BioGrace has to be used together with another scheme

Time schedule

- Send in BioGrace tool to EC for recognition early April
- Recognition period lasts … ?

Thank you for your attention

Intelligent Energy Europe

The sole responsibility for the content of this presentation lies with the authors. It does not necessarily reflect the opinion of the European Union.

The European Commission is not responsible for any use that may be made of the information contained therein.