BIOGRACE
Harmonised Calculations of Biofuel Greenhouse Gas Emissions in Europe

Introduction to the project BioGrace

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ADEME
Public workshop Paris
May 19, 2011

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1. Introduction
2. Why harmonisation of biofuel GHG calculations?
3. Project BioGrace
4. One list of standard values
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Introduction

GHG calculations under Renewable Energy Directive (RED) and Fuel Quality Directive (FQD)

- RED and FQD: same sustainability criteria including GHG
- RED article 19:
  - Economic operators may use
    - default values (19.1.a)
    - actual values calculated according to Annex V.C (19.1.b)
    - sum of actual value and disaggregated default value (19.1.c)
  - In Europe default values only when feedstock is produced in area on list (19.2) or from waste/residue
- RED article 18:
  - Independent auditors must check information (18.3)
  - Can be part of voluntary certification schemes (18.4)

Introduction

- o Input data
- o Standard values ("conversion factors")

Cultivation of rapeseed			Calculated emissions			
Yield			**Emissions per MJ FAME**			
			g CO_2	g CH_4	g N_2O	g $CO_{2, eq}$
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} $year^{-1}$	6,07	0,00	0,00	6,07
Agro chemicals						
N-fertiliser	137,4	kg N ha^{-1} $year^{-1}$	9,08	0,03	0,03	18,89
CaO-fertiliser	19,0	kg CaO ha^{-1} $year^{-1}$	0,05	0,00	0,00	0,06
K_2O-fe...						
P_2O_5-...						
Pestic...						
Seeding material						
Seeds- rapeseed	6	kg ha^{-1} $year^{-1}$	0,06	0,00	0,00	0,10

STANDARD VALUES parameter:	GHG emission coefficient			
unit:	gCO_2/kg	gCH_4/kg	gN_2O/kg	gCO_{2-eq}/kg
N-fertiliser	2827,0	8,68	9,6418	5880,6

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Why harmonisation of biofuel GHG calculations?

EXAMPLE 1: Different results from same biofuel
(same input values but different standard values)

Standard values	Unit	Source EC (RED Annex V)	Netherlands (Ecofys / CE)	UK RFA	Germany IFEU
Nitrogen Fertilizer	g CO_{2eq}/kg	5917,2	6367,0	6800,0	6410
P fertilizer	g CO_{2eq}/kg	1013,5	700,0	354 for TSP, **95** for rock phosphate, 596 for MAP	1180
K fertilizer	g CO_{2eq}/kg	579,2	453,0	333,0	663
CaO fertilizer (85%CaCO3+15%CaO,Ca(OH)2)	g CO_{2eq}/kg	130,0	179,0	124,0	297
Pesticides	g CO_{2eq}/kg	11025,7	17256,8	17300,0	1240
Diesel (direct plus indirect emissions)	g CO_{2eq}/MJ	87,6	76,7	86,4	89,1
Natural gas (direct plus indirect emissions)	g CO_{2eq}/MJ	68,0	53,9	62,0	62,8
Methanol (direct plus indirect emissions)	g CO_{2eq}/MJ	98,1	137,5	138,5	62,5

Why harmonisation of biofuel GHG calculations?

1. Significant variation possible in actual GHG values (RED 19.1.b) following RED Annex V.C
   - Using same input values
   - Caused by variation in standard values (or "conversion factors" / "background processes") to convert kg, MJ or m^3 into $CO_{2,eq}$
2. This causes a problem using actual GHG values
   - Auditors can not check if standard values are correct
   - Economic operators can enhance the GHG performance of their biofuel without decreasing actual GHG emissions
3. Several GHG experts and MS policy makers…
   - …agree that harmonisation of standard values is best solution
   - …intend to implement this solution

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Project BioGrace

Biofuel **Gr**eenhouse Gas emissions:
alignment of **c**alculations in **E**urope

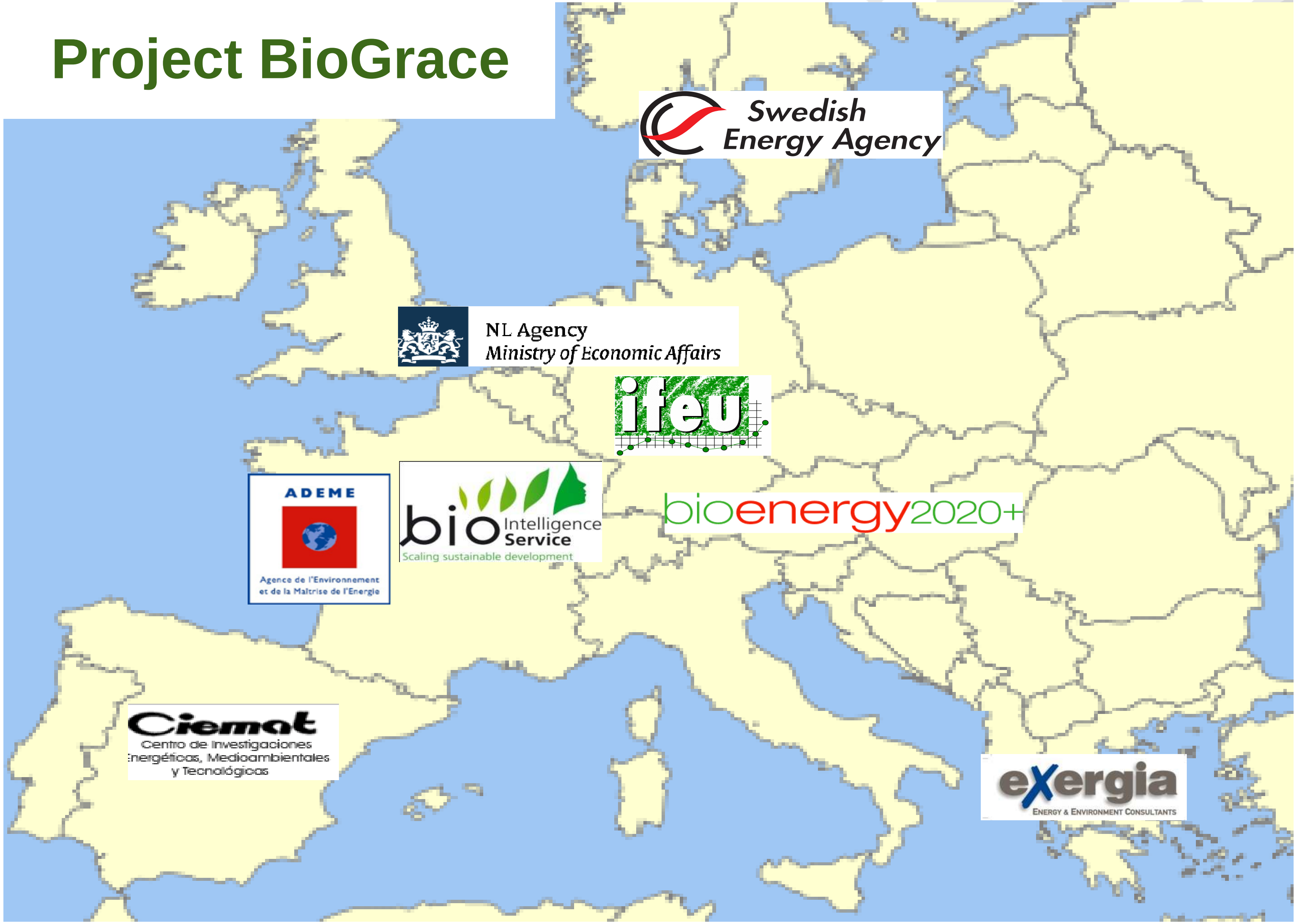
Aim of project:

- o Harmonise calculations of biofuel greenhouse gas (GHG) emissions performed in EU-27 under legislation implementing the Renewable Energy and Fuel Quality directives

Consortium

- o Agencies/organisations close to national governments and experts in GHG calculations
  - – Coordinator: Agentschap NL (formerly SenterNovem)
  - – Partners: ADEME, BE2020, BIO-IS, CIEMAT, IFEU, EXERGIA, STEM

Project BioGrace



Project BioGrace

Key objectives are:

1. **Cause transparency**
   Reproduce biofuel default GHG values (Annex V RED)
   - Has not been done by the Commission or JEC
   - Is a recurrent exercise
2. **Cause harmonisation**
   Cause that GHG calculation tools give the same results
3. **Facilitate stakeholders**
   Allow relevant stakeholders to calculate actual values
4. **Disseminate results**
   Make our results public to all relevant stakeholders

Project BioGrace

Key objectives are:

1. **Cause transparency**
   Reproduce biofuel default GHG values (Annex V RED)
2. **Cause harmonisation**
   Cause that GHG calculation tools give the same results
   - All tools that are linked to our project
   - Note: this is a policy effort, not a scientific effort
3. **Facilitate stakeholders**
   Allow relevant stakeholders to calculate actual values
4. **Disseminate results**
   Make our results public to all relevant stakeholders

Project BioGrace

Key objectives are:

1. **Cause transparency**
   Reproduce biofuel default GHG values (Annex V RED)
2. **Cause harmonisation**
   Cause that GHG calculation tools give the same results
3. **Facilitate stakeholders**
   Allow relevant stakeholders to calculate actual values
   - By providing them calculation tools
   - By improving tools following stakeholder input
4. **Disseminate results**
   Make our results public to all relevant stakeholders

Project BioGrace

Key objectives are:

1. **Cause transparency**
   Reproduce biofuel default GHG values (Annex V RED)
2. **Cause harmonisation**
   Cause that GHG calculation tools give the same results
3. **Facilitate stakeholders**
   Allow relevant stakeholders to calculate actual values
4. **Disseminate results**
   Make our results public to all relevant stakeholders
   - All information is available through www.BioGrace.net
   - All information is for free !
   - Public stakeholder workshops

Contents

One list of standard values

List of standard values

- o is publicly available
- o to be used by everyone that makes GHG calculations under RED/FQD based legislation

We are achieving this by:

- – Including values in all software tools
- – Causing that list is known by all GHG calculation experts
- – Showing that these (and only these) standard values lead to RED defaults
- – Requesting policy makers to make reference from national legislation (implementing RED / FQD)

One list of

Version 3 - Public

STANDARD VALUES parameter: unit:	gCO								
Global Warming Potentials (GWP's)									
CO_2									
CH_4									
N_2O									
Agro inputs									
N-fertiliser	282								
P_2O_5-fertiliser	964								
K_2O-fertiliser	536								
CaO-fertiliser	119								
Pesticides	988								
Seeds- corn									
Seeds- rapeseed	412								
Seeds- soy bean									
Seeds- sugarbeet	218								
Seeds- sugarcane	1,								
Seeds- sunflower	412								
Seeds- wheat	151								
EFB compost (palm oil)	0,								
Fuels- gasses									
Natural gas (4000 km, Russian NG quality)									
Natural gas (4000 km, EU Mix qualilty)									
Fuels- liquids									
Diesel		87,64	-	-	87,64		1,16	832	43,1
Gasoline								745	43,2
HFO		84,98	-	-	84,98		1,088	970	40,5
Ethanol								794	26,81
Methanol		92,80	0,2900	0,0003	99,57		1,6594	793	19,9
FAME								890	37,2
Syn diesel (BtL)								780	44,0
HVO								780	44,0
Fuels / feedstock / byproducts - solids									
Hard coal									26,5
Lignite									9,2
Corn									18,5
FFB									24,0
Rapeseed									26,4
Soybeans									23,5
Sugar beet									16,3
Sugar cane									19,6
Sunflowerseed									26,4
Wheat									17,0
Animal fat									37,1
BioOil (byproduct FAME from waste oil)									21,8
Crude vegetable oil									36,0
DDGS									16,0
Glycerol									16,0
Palm kernel meal									17,0

Condensed list of standard values, version 3 - Public

This file gives the standard values as published on www.biograce.net in Word format.

Two Word versions of this list exist:

1. A complete list of standard values, containing all the values as listed in the Excel version
2. A condensed list showing the most important standard values

This file contains the condensed list.

Abbreviations and definitions used can be found in the Excel file on the web page http://www.biograce.net/content/ghgcalculationtools/standardvalues.

1 Global Warming potentials

CO_2	1	g $CO_{2,eq}$ / g CO_2
CH_4	23	g $CO_{2,eq}$ / g CH_4
N_2O	296	g $CO_{2,eq}$ / g N_2O

2 GHG emission coefficients

N-fertiliser	5880,6	g $CO_{2,eq}$/kg N
P_2O_5-fertiliser	1010,7	g $CO_{2,eq}$/kg P_2O_5
K_2O-fertiliser	576,1	g $CO_{2,eq}$/kg K_2O
CaO-fertiliser	129,5	g $CO_{2,eq}$/kg CaO

Both Excel and Word versions available at www.BioGrace.net

One list of standard values

List of standard values

- European Commission makes reference to list

Transparency & harmonisation

One list of standard values

List of standard values

- European Commission makes reference to list
- Member States include list in Technical Guidance:
  - Austria, Sweden, UK are preparing to do
  - Germany, Ireland, Netherlands are about to decide to do so
- Example (from UK consultation on C&S Technical Guidance)
  - *The RFA therefore proposes the following approach to which standard values should be used:*
    1. For the reporting period 2011/2012, the RFA proposes to ***align its current standard emission factors with the ones proposed by the BioGrace project****.*

Project BioGrace

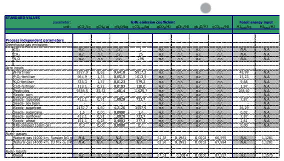
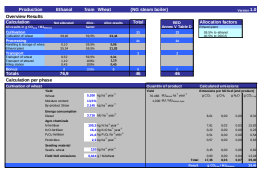
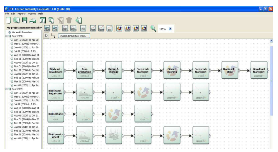
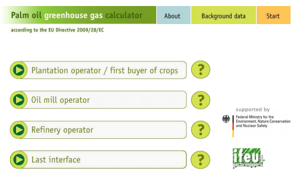
- BioGrace will also:
  - make a list of additional standard values
  - list rules for making actual calculations
  - add ‘sophisticated’ support sheets for calculation of
    - ✓ direct land use change (based on Commission Decision)
    - ✓ N_2O emissions (based on IPCC Tier 1)
- BioGrace will not:
  - add pathways to the Excel file with GHG calculations that are not listed in RED Annex V
  - help directly stakeholders make actual calculations
  - check actual calculations at the request of stakeholders
- Feedback by stakeholders is warmly welcomed

Contents

Concluding summary

- One biofuel, different GHG calculations => different results
- IEE funded project BioGrace will:

1. Cause harmonisation
   - Excel tool and GHG calculators give same result
   - All GHG calculations based on one set of standard values
2. Cause transparency
   in how RED default values were calculated
3. Facilitate stakeholders
   - Tools that allow own input and/or modifications to pathways
4. Broadly disseminate results

Thank you for your attention

Intelligent Energy Europe

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Project BioGrace

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- Project partners:
  - ADEME, France (Bruno Gagnepain)
  - BE2020, Austria (Dina Bacovsky)
  - BIO IS, France (Remy Lauranson)
  - CIEMAT, Spain (Yolanda Lechon)
  - EXERGIA, Greece (Konstantinos Georgakopoulos)
  - IFEU, Germany (Horst Fehrenbach)
  - STEM, Sweden (Matti Parikka)
- Project duration: 2 years (April 2010 – March 2012)
- Project website: www.BioGrace.net

Project BioGrace – project background

Two approaches (ways of thinking) to perform biofuel GHG calculations on individual batches of biofuels

Poorer *Applicability (part of legislation)* *Better*

High *Complexity* *Low*

Scientific approach:

- High level of accuracy
- Case-specific numbers
- Variation (*eg* multiple years: crop rotation)
- Focus on correctness of results

Policy approach:

- Compromise between accuracy and applicability
- Average numbers
- Unambiguous and limited amount of variation
- Focus on applicability as part of legislation

Formulation of project BioGrace

1. Dresden workshop (June 2, 2009) led to project
   - based on finding that harmonisation is needed
   - initiated by advisors to governments with expertise on GHG calculations (IFEU, RFA, SenterNovem = NL Agency)
2. Project received letters of support from governments
   - France, Germany, Netherlands, Spain, UK
3. Proposal for subsidy from “Intelligent Energy Europe”
   - Advantage: funding from EC
   - Disadvantage: long lead time (submission end of June 2009, start project in April 2010)
4. Work was already started 2nd half of 2009
   - Because of tight timeline implementation RED
5. Final preparation of project
   - Contract negotiation Dec. 2009 – March 2010

One list of standard values

- o Input data
- o Standard values ("conversion factors")

Cultivation of rapeseed			Calculated emissions			
			Emissions per MJ FAME			
Yield			$g\ CO_2$	$g\ CH_4$	$g\ N_2O$	$g\ CO_{2,\ eq}$
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	$MJ\ ha^{-1}\ year^{-1}$	6,07	0,00	0,00	6,07
Agro chemicals						
N-fertiliser	137,4	$kg\ N\ ha^{-1}\ year^{-1}$	9,08	0,03	0,03	18,89
CaO-fertiliser	19,0	$kg\ CaO\ ha^{-1}\ year^{-1}$	0,05	0,00	0,00	0,06
K_2O-f						
P_2O_5-						
Pestic						
Seeding material						
Seeds- rapeseed	6	$kg\ ha^{-1}\ year^{-1}$	0,06	0,00	0,00	0,10

STANDARD VALUES	GHG emission coefficient			
parameter:				
unit:	gCO_2/kg	gCH_4/kg	gN_2O/kg	$gCO_{2\text{-}eq}/kg$
N-fertiliser	2827,0	8,68	9,6418	5880,6

Project BioGrace

Key objectives are:

1. Cause transparency
2. Cause harmonisation
3. Facilitate stakeholders
4. Disseminate results

Why harmonisation of biofuel GHG calculations?

EXAMPLE 1: Different results from same biofuel
(same input values but different standard values)

Standard values

Nitrogen Fertilizer

P fertilizer

K fertilizer

CaO fertilizer (85%CaCO3+15%CaO,Ca(

Pesticides

Diesel (direct plus indirect emissions)

Natural gas (direct plus indirect emissions

Methanol (direct plus indirect emissions)

Production of FAME from Rapeseed

Overview Results

All results in g $CO_{2,eq}$ / MJ_{FAME}	Total	Default values RED Annex V.D
Cultivation e_{ec}	27,7	29
Cultivation of rapeseed	27,29	28,51
Rapeseed drying	0,42	0,42
Processing e_p	16,5	22
Extraction of oil	3,29	3,82
Refining of vegetable oil	0,85	17,88
Esterification	12,39	
Transport e_{td}	1,3	1
Transport of rapeseed	0,15	0,17
Transport of FAME	0,73	0,82
Filling station	0,44	0,44
Land use change e_l	0,0	0
$e_{sca} + e_{ccr} + e_{ccs}$	0,0	0
Totals	**45,6**	**52**

Emission reduction
Fossil fuel reference (diesel)
83,8 g $CO_{2,eq}$/MJ
GHG emission reduction
46%

One list of standard values

List of standard values

- o When motivated, other standard values can be used
- o BioGrace will publish a calculation rule for this, stating that

  – For standard values not yet on the list
    - a reliable source (literature, database) should be given
    - auditors can verify this information conform RED Article 18.3

  – For standard values that are already listed:
    - reliable information is submitted showing how these values were determined
    - auditors can verify this information conform RED Article 18.3.
    - it is shown that this input was used in the production of the biofuel
    - the use of this alternative standard value does not contradict any other calculation rule

BIOGRACE
Harmonised Calculations of
Biofuel Greenhouse Gas Emissions in Europe

The BioGrace Excel GHG calculation tool - Basics

Rémy LAURANSON
BIO IS
Public workshop Paris
May 19, 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

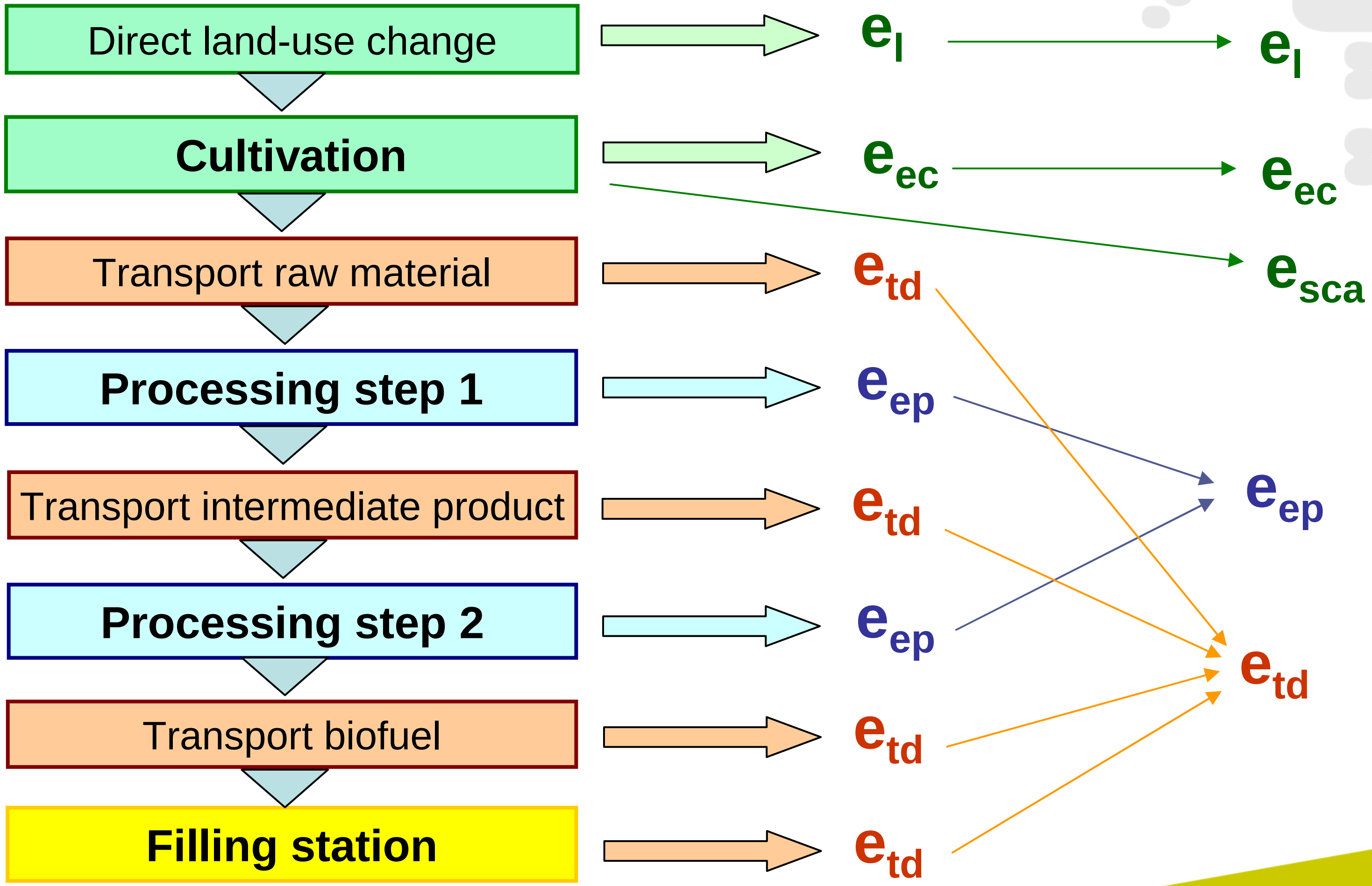
e_{sca}: methodology still under discussion

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**			
				g CO_2	g CH_4	g N_2O	g $CO_{2,eq}$
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

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			
Yield			**Yield**	**Emissions per MJ FAME**			
				g CO_2	g CH_4	g N_2O	g $CO_{2,eq}$
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	
		per kg rapeseed	per ha, year
Yield			
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			
Yield					**Emissions per MJ FAME**			
					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

Rémy LAURANSON
BIO IS
Public workshop Paris
May 19, 2011

Contents

Introduction

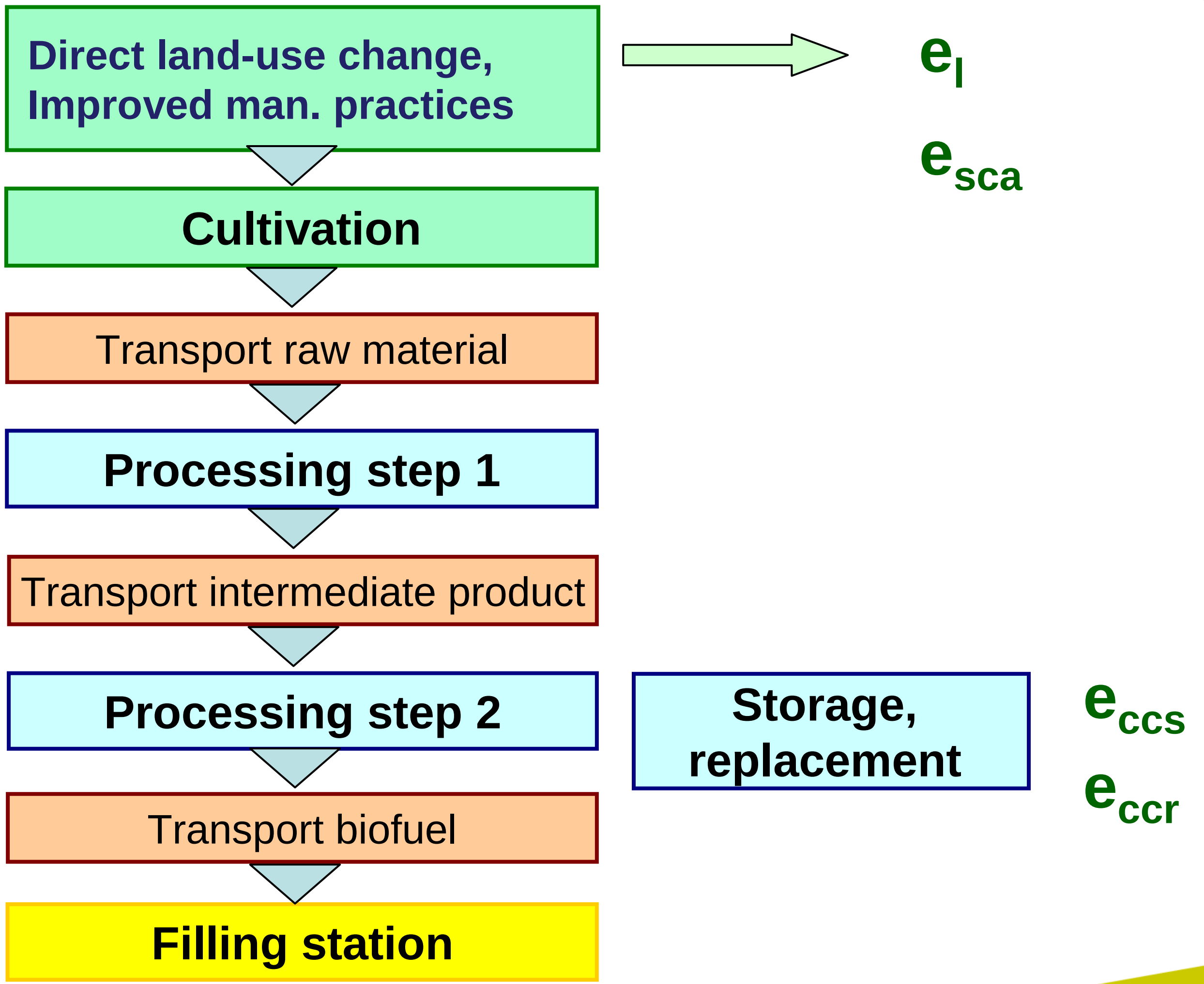
$$E = e_{ec} + e_l + e_p + e_{td} + e_u - e_{sca} - e_{ccs} - e_{ccr} - e_{ee},$$

$ee_{ccs/ccr}$: 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



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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 :

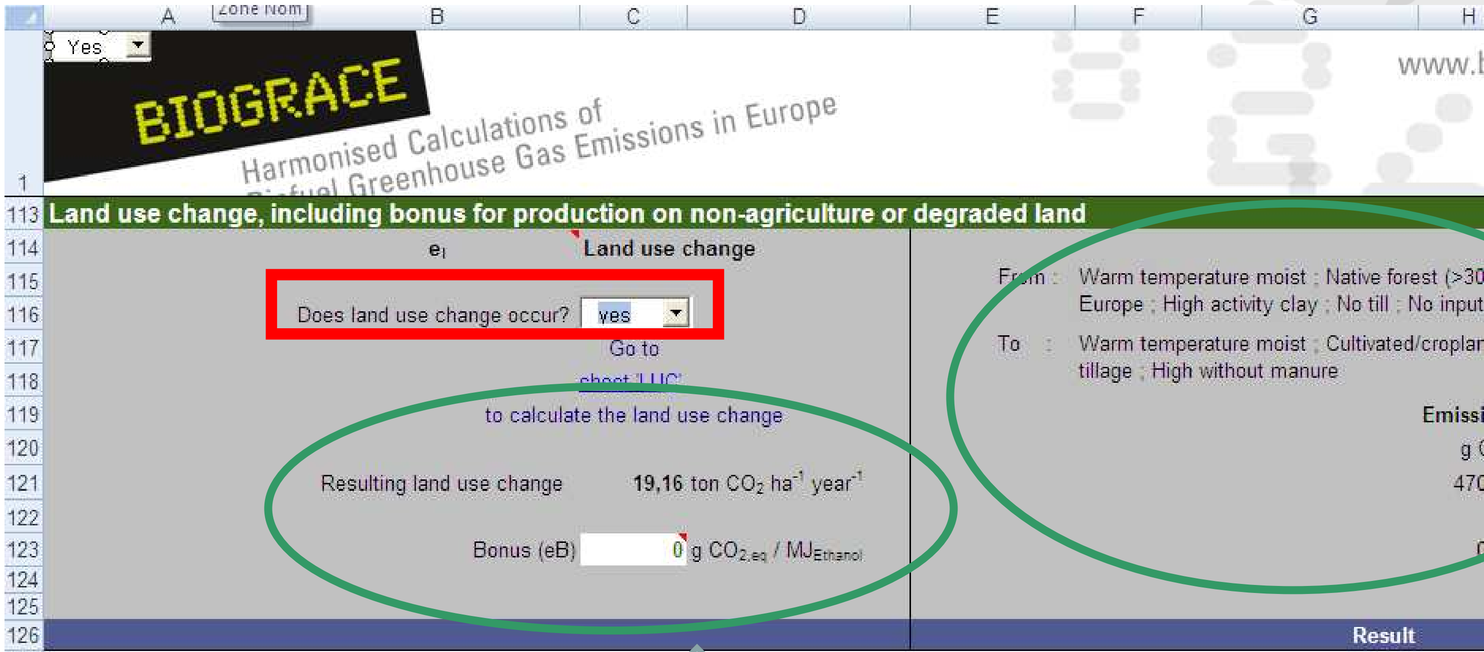
1. *Calculation using default value*

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

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

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

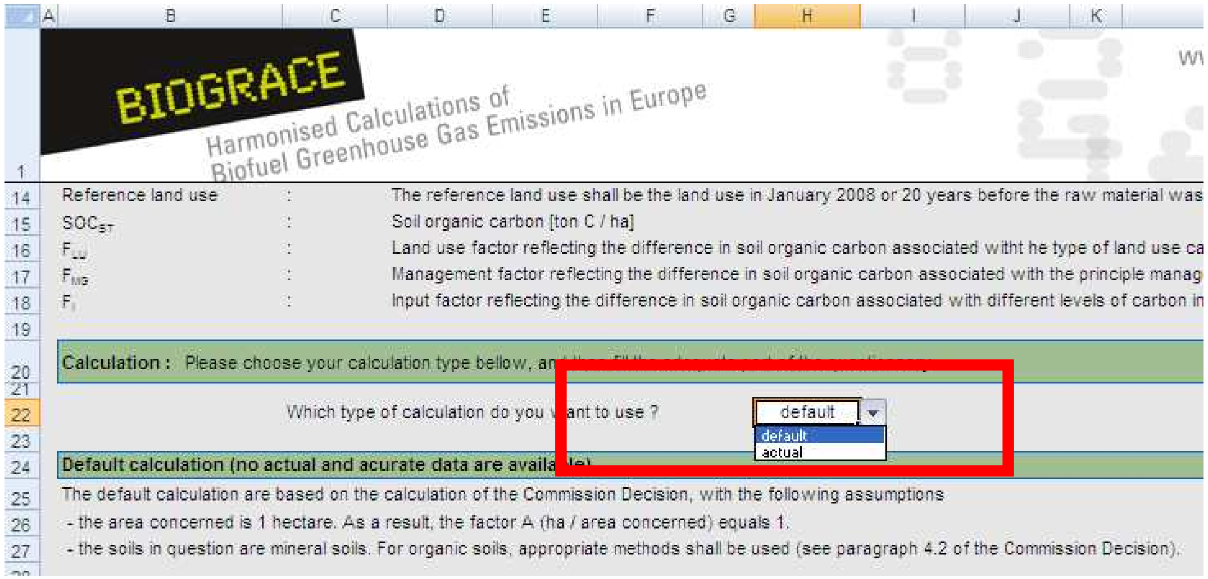
Step 1 : declare LUC in your pathway



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.



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Harmonised Calculations of Biofuel Greenhouse Gas Emissions in Europe

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

Row		Actual land use		Reference land use		
29	CS_A and CS_R are calculated with the following equation:			$CS_i = C_{VEG} + SOC_{ST} * F_{LU} * F_{MG} * F_I$		
30						
31		**Actual land use**		**Reference land use**		
32						
33	Climate region	Warm temperature moist		Warm temperature moist		
34	Vegetation/crop (land use)	Cultivated/cropland		Native forest (>30% canopy cover)		
35						
36	Above and below ground vegetation					
37	Ecological zone (if relevant)	-		Oceanic forest		
38	Continent (if relevant)	-		Europe		
39	C_{VEG}	0	ton C / ha	84	ton C / ha	Calculate value according to Chapter 5, or look up val
40						
41	Carbon stock in mineral soil					
42	Climate region	Warm temperature moist		Warm temperature moist		Determine using paragraph 6.1 of Commission Decisio
43	Soil type	High activity clay		High activity clay		Determine using paragraph 6.2 of Commission Decisio
44	Soil management	Full-tillage		No till		Determine using table 3 of Commission Decision
45	Input	High without manure		No input		Determine using table 3 of Commission Decision
46						
47	SOC_{ST}	88	ton C / ha	88	ton C / ha	Loop up in Table 1 of Commission Decision, using clim
48	F_{LU}	0,69		1		Look up in Tables 2 - 8 of Commission Decision
49	F_{MG}	1		n/a		Look up in Tables 2 - 8 of Commission Decision
50	F_I	1,11		n/a		Look up in Tables 2 - 8 of Commission Decision

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

7.1. **Cropland**

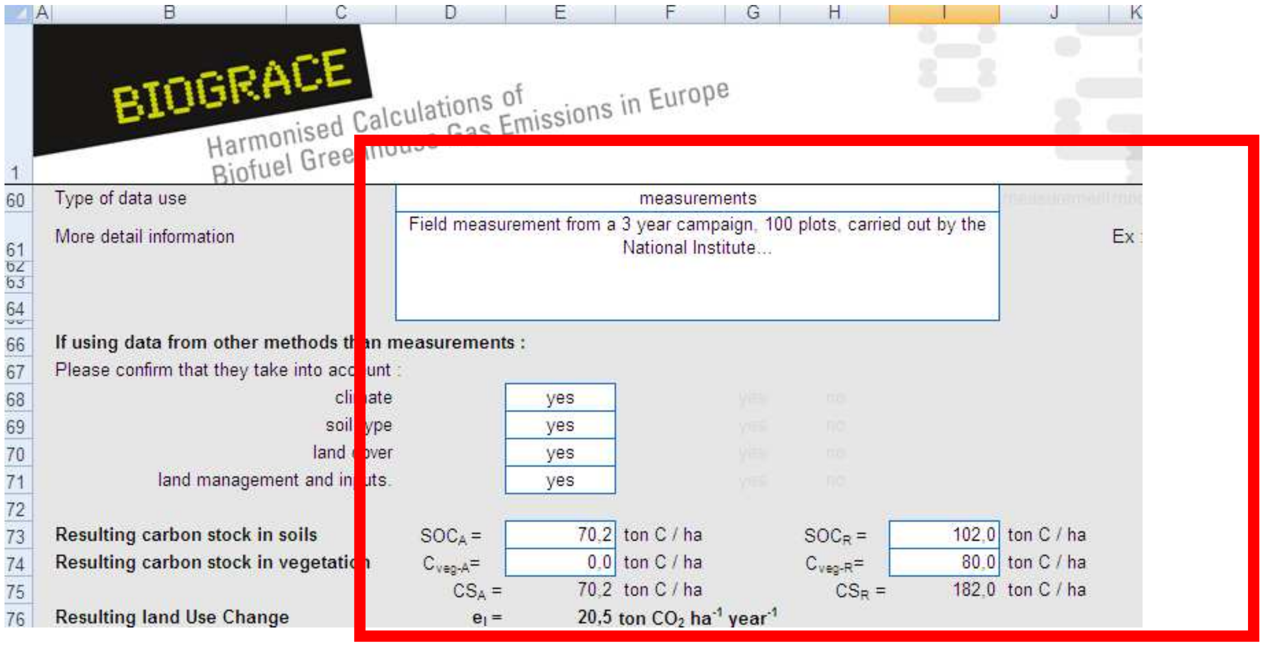
Table 2

Factors for cropland

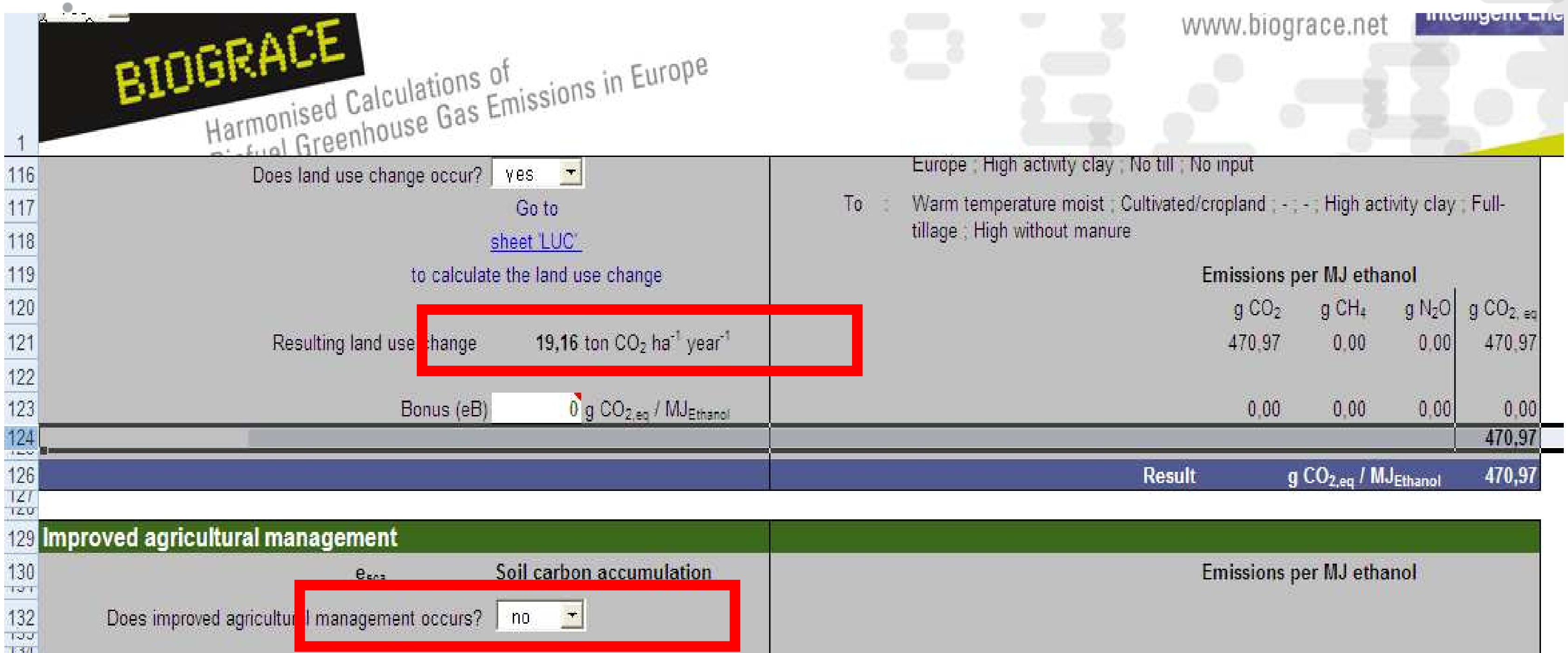
Climate region	Land use (F_{LU})	Management (F_{MG})	Input (F_I)	F_{LU}	F_{MG}	F_I
Temperate/Boreal, dry	Cultivated	Full-tillage	Low	0,8	1	0,95
			Medium	0,8	1	1
			High with manure	0,8	1	1,37
			High without manure	0,8	1	1,04
		Reduced tillage	Low	0,8	1,02	0,95
			Medium	0,8	1,02	1

Row					
52					
53	**Resulting carbon stock**	CS_A =	67,4 ton C / ha	CS_R =	172,0 ton C / ha
54	**Resulting LUC**	e_l =	19,16 ton eq CO_2 / ha / an		

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



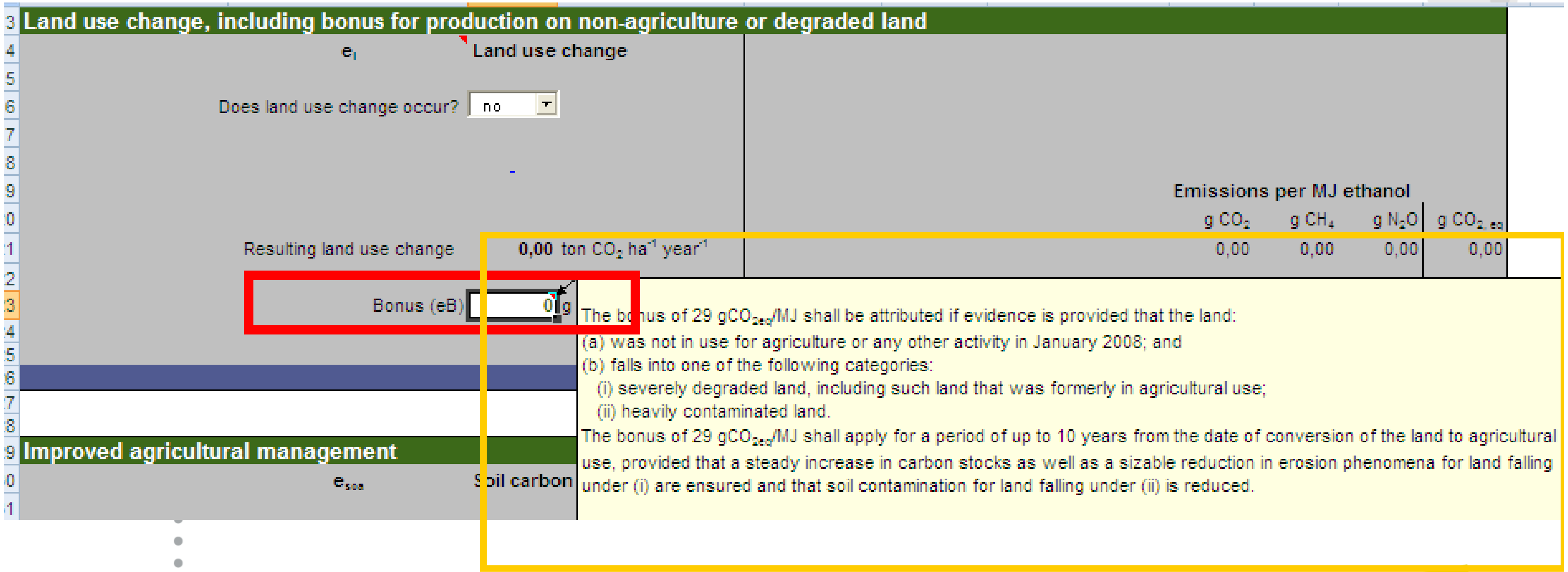
- **Step 5 :** Check in the biofuel pathway that the LUC value is there. Please, also check that no Improved agricultural management is declared.



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



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

1. Introduction
2. Land use change
3. Improved agricultural management
4. CO_2 storage or replacement
5. New items in Public version 4
   - User manual
   - Calculation rules
   - Track changes
6. New item for Public version 5:
   - Calculation of N_2O field emissions

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

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New items in Public version 4

Track changes

- One of the calculation rules:
  - *“Use ‘track changes’ for verification purposes”*

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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*~~
- [x] **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

Track changes: ON

Calculation per phase

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

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.

Please enter the data for your crop in the blue cell

Crop name	Sugar cane	
Crop yield (fresh matter)	1000	kg $_{fm}$/ha
Humidity(%)	45,0%	
Crop yield (dry matter)	550	kg $_{dm}$/ha
Straw yield (removed from the field)		kg dm/ha
Amount of vignasse applied to the field (by default 0.94		kg of vignasse dry / kg sucar cane fm
Amount of filter cake applied to the field (by default 0.01)		kg of filter cake dry/kg sugar cane fm
N content of vignasse applied to the field (by default 0.36)		kg N / t vignasse
N content of filter cake applied to the field (by default 12.5)		kg N / t filter cake
Carbon loss due to land use change	0	t/ha
Is the crop irrigated OR is rainfall in rainy season minus potencial evaporation higher than soil water holding capacity?	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 ...					
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}			
$Frac_{LEACH}$			
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

Thank you for your attention

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BIOGRACE

Harmonised Calculations of Biofuel Greenhouse Gas Emissions in Europe

National GHG calculators – harmonized in co-operation with BioGrace

Bruno GAGNEPAIN
ADEME
Public workshop Paris
May 19, 2011

Contents

Introduction

Rules and methodology for GHG calculations

- RED article 19: Economic operators may use
  - o default values (19.1.a)
  - o actual values calculated according to Annex V.C (19.1.b)
  - o sum of actual value and disaggregated default value (19.1.c)
- RED Annex V.C + June communications: Methodology

Making actual calculations not straightforward

- Some kind of tool or software is needed
  - o Some companies will develop own tools
  - o Many others will use publicly available tools

Several GHG calculators available

Project BioGrace will ensure that all calculators will give the same result

Contents

Dutch tool - General information

Background

- Dutch government prepared a reporting obligation on sustainability for biofuels to start per 1-1-2009
- This was abandoned after the publication of the draft Renewable Energy Directive (RED).

The Dutch GHG calculator

- was developed in 2007/2008 by consultants EcoFys and CE
- has been available for (Dutch) stakeholders to make GHG calculation on biofuels
- has not been used extensively due to lack of legal framework in 2008 – 2010
- was recently updated and made “RED”- proof by Agency NL

Dutch tool - Summary

Contents

- Excel-based tool
- Tool is rather similar to BioGrace Excel sheets, but
  - It is more user-friendly:
    no calculations details, results in graphs
  - DLUC calculations are user-friendly
- The software programming makes it less flexible
  - More difficult to modify pathways or build new ones

Status

- Tool is available on-line via
  www.senternovem.nl/gave_english/ghg_tool
- All 22 chains (BioGrace) are included
- Updates follow updates of BioGrace Excel sheet

Contents

German tool - general information

Background

- No public tool has been available so far in Germany
- Aim: to facilitate stakeholders calculating actual values (combination of actual values and disaggregated default values)

The German GHG calculator

- is made by IFEU, contracted by BMU
- should be finalised mid 2011
- should be in line with BLE Guidance
- is strongly linked to economic operators: 1 sheet dedicated for cultivators, mill operators, refinery operators, etc.

German tool - general information

Background

- 7 German crop specific tools,
  first tool (palm oil) published online September 27th 2010
  next 4 tools will be online in June 2011
- made by IFEU, contracted by BMU
- Stakeholder, regulator and expert workshops
- Finalizing with large verifier workshop in October 2011

The German GHG calculator

- Focus of BioGrace tool: transparent reproduction of the Annex V defaults
- Focus of national calculator: user friendliness tailored to a narrow target group (non-expert user: farmers, oil millers, refinery operators, last interface)
- Main differences:
  - strongly linked to economic operators: 1 sheet dedicated for cultivators, mill operators, refinery operators, etc.
  - Reference units for GHG emissions different in each sheet (kg FFB, kg CPO, kg refined oil)

German tool - Summary

Contents

- o Excel-based tool
- o The software programming makes it inflexible
  - – Not possible to modify pathways or build new ones

Status

- o Palm oil tool available via www.ifeu.de
- o Tools ready but not available online:
  - Cereals-to-ethanol (wheat, barley, rye, triticale, corn)
  - Plant oil (rapeseed, sunflower, soy)
  - Biodiesel
  - Biogas
- o Tools in pipeline
  - Sugarbeet-to-ethanol
  - Sugarcane-to-ethanol
- o Should be finalised mid 2011

Contents

Spanish tool - general information

Background

- No public tool has been available so far in Spain
- Aim: to provide stakeholders (especially farmers and small biofuel companies) with a tool to calculate the GHG emissions required by the RED

The Spanish GHG calculator

- being developed by CIEMAT, contracted by IDAE
- focuses on agricultural stages
- uses data from NUTS study (actual values or averages calculated for smaller geographical areas)

Spanish tool - Summary

Contents

- Tool build in Java
- Focus on Spain:
  - Contains data on agricultural inputs and yields for 6 crops used to produce biofuels in Spain at the level of agrarian county (NUTs4)
  - Any farmer in the country can select his/her county and crop and the corresponding values regarding agricultural inputs and yields will appear in the tool.
- For processing and transport: RED default values
- Standard values from BioGrace

Status

- Biodiesel from rapeseed, rapeseed HVO and ethanol from wheat CHP chains ready
- Final version expected mid-2011

Contents

UK tool - general information

Background

- UK GHG calculator was developed under RTFO reporting scheme
- Calculator existing since 2008, regularly updated
- Aim is to facilitate stakeholders calculating actual values under RTFO reporting

The UK GHG calculator

- was made and is regularly updated by consultant E4Tech, contracted by RFA
- has recently been made “RED-proof”
- strongly linked to RTFO reporting scheme
- provides more “standard values” as compared to BioGrace

UK tool - Summary

Contents

- Tool build in LCA-software package
- Tool can produce supplier monthly and annual C&S reports
- Tool differs from BioGrace Excel sheets:
  - More than 250 biofuel production pathways included
  - DLUC calculations not included
- The software programming makes it flexible
  - Rather easy to modify pathways or build new ones

Status

- Tool on-line via www.renewablefuelsagency.gov.uk including a user manual
- All chains available (and more) but not all chains give same result (yet) as compared to RED defaults

Contents

BIOGRACE

Harmonised Calculations of Biofuel Greenhouse Gas Emissions in Europe

Intelligent Energy Europe

Comparison of results

Check list Version 3.0 February 2011	Default greenhouse gas emissions						
	Table A RED Annex V/FQD Annex IV	BIOGRACE W3		BIOGRACE WP4 National GHG Calculators			
Biofuel production pathways	Default value	1/25/298	1/23/296	The Netherlands ANL	Germany IFEU	Spain CIEMAT	UK
Ethanol wheat lignite	70	69.9	69.8	69.9	67.9		70
Ethanol wheat (proces fuel not specified)	70	69.9	69.8	69.8	67.9		70
Ethanol wheat (natural gas - steam boiler)	55	54.9	54.6	54.6	52.8	55.61	55
Ethanol wheat (natural gas - CHP)	44	44.3	44.1	44.1	42.2		44
Ethanol wheat (straw)	26	26.1	26.0	26.0	24.0		26
Ethanol corn	43	43.6	43.4	43.4	42.6		43
Ethanol sugarbeet	40	40.3	40.1	40.1			40
Ethanol from sugarcane	24	24.3	24.0	24.0			24
Biodiesel rape seed	52	52.0	51.7	51.8		52.51	52
Biodiesel palm oil	68	68.7	66.0	66.0	68.9		68
Biodiesel palm oil (methane capture)	37	37.1	36.9	37.0	36.3		37
Biodiesel soy	58	57.2	56.9	57.0			58
Biodiesel sunflower	41	40.8	40.6	40.6			41
Biodiesel UCO	14	21.4	21.3	21.3			14
PVO rape seed	36	36.1	35.9	31.2			36
HVO rape seed	44	44.5	44.2	44.2		44.57	44
HVO palm oil	62	61.6	58.9	58.9			62
HVO palm oil (methane capture)	29	29.1	29.0	29.0			29
HVO sunflower	32	32.9	32.7	32.7			32
Biogas - dry manure	15	14.3	13.0	12.9			15
Biogas - wet manure	16	15.8	14.5	14.4			16
Biogas - MSW.	23	22.7	21.4	21.4			23
	1/25/298	1/25/298	1/23/296	1/23/296	1/25/298	1/23/296	

Public workshop Paris

May 19, 2011

Contents

Conclusions

Several GHG calculators available

- Two exist since 2008, three (including BioGrace Excel sheets) are newly developed
- Project BioGrace will ensure that all calculators will give the same result
- Some allow to modify or build new pathways, others don't

National GHG calculators have different aims

- Some are more focussed on national data or national reporting, others are more international oriented
- Focus on different aspects
  - Agricultural stages (Spain)
  - Supply of data through the chain of custody (Germany)

Thank you for your attention

Intelligent Energy Europe

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BIOGRACE

Harmonised Calculations of Biofuel Greenhouse Gas Emissions in Europe

Intelligent Energy Europe

Dutch GHG tool

Reference: Diesel

Biofuel: Biodiesel

Feedstock: Rapeseed

Load Default Values | Calculate Results | Adapt Chain | Chain management | Disclaimer

D = Default; U = User input

Version 3.1 - aug

Current chain: Biodiesel from Rapeseed (not saved by user)

Feedstock production					
Yield main product	Raw rapeseed		3113	kg / (ha*yr)	D
Main product	Moisture content		0,10	kg / kg	D
Material & energy use	Diesel		2963	MJ / (ha*yr)	D
Material & energy use	N fertilizer		137,4	kg N / (ha*yr)	D
Material & energy use	CaO fertilizer		19,00	kg CaO / (ha*yr)	D
Material & energy use	K2O fertilizer		49,46	kg K2O / (ha*yr)	D
Material & energy use	P2O5 fertilizer		33,67	kg P2O5 / (ha*yr)	D
Material & energy use	Pesticides		1,230	kg / (ha*yr)	D
Material & energy use	Seeding material - rapeseed		6,000	kg / (ha*yr)	D
Field emissions	Field N2O emissions		3,103	kg / (ha*yr)	D
Field emissions	Direct Land Use Change	No		g CO2/MJbiofuel	D
Feedstock drying					
Yield main product	Dried rapeseed		1,000	MJdried rapeseed / (MJraw rapeseed)	D
Main product	Moisture content		0,10	kg / kg	D
Material & energy use	Diesel		0,181	MJ / (GJdried rapeseed)	D
Material & energy use	Electricity (EU-mix, LV)		3,079	MJ / (GJdried rapeseed)	D
Transport feedstock					
Yield main product	Dried rapeseed		0,990	MJdried rapeseed / (MJdried rapeseed)	D
Main product	Moisture content		0,10	kg / kg	D
Transport	Truck for dry product (Diesel)		50	km	D
Extraction in oil mill					
Yield main product	Crude vegetable oil		0,613	MJcrude oil / (MJdried rapeseed)	D
Yield by-product	Rapeseed cake		0,387	MJrapeseed cake / (MJdried rapeseed)	D

BIOGRACE
Harmonised Calculations of Biofuel Greenhouse Gas Emissions in Europe

Intelligent Energy Europe

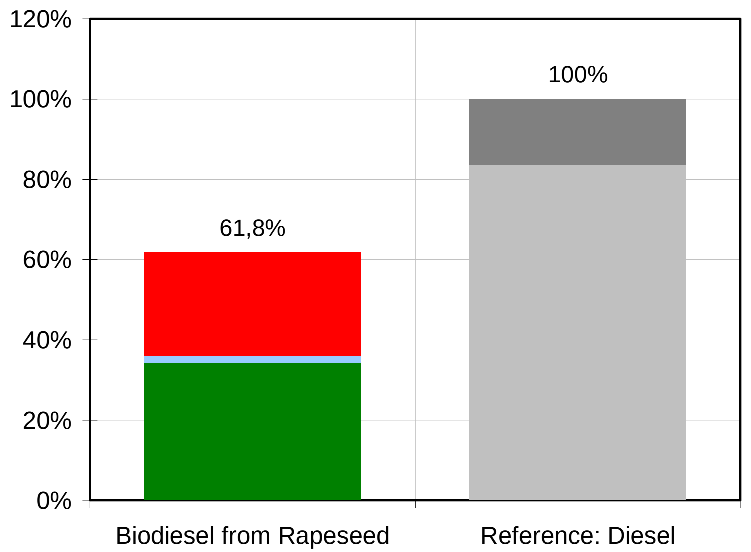
Dutch GHG tool

Summary Input		Summary output	Biodiesel from Rapeseed				Reference: Diesel			
			Energy use (per MJ)		GHG emissions (kg/MJ)		Energy use (per MJ)		GHG emissions (kg/MJ)	
			(MJ)	(% of ref.)	(g CO2-eq.)	(% of ref.)	(MJ)	(%)	(g CO2-eq.)	(%)
Biofuel	Biodiesel	Feedstock production	0,1672	14%	28,7496	34%				
Feedstock	Rapeseed	Transport actions	0,0233	2%	1,4345	2%				
Process	-	Conversion operations	0,3677	32%	21,5636	26%				
Reference	Diesel									
Print summary results		End use					1,0000	87%	70,1047	84%
Show detailed results		Fossil indirect					0,1550	13%	13,6953	16%
		Total	0,5582	48,3%	51,7477	61,8%	1,1550	100%	83,8000	100%
Return to input		**% Reduction**		**51,7%**		**38,2%**				**0%**
		Avoided emission (tonne CO_2/ha/yr)			**1371,5**					

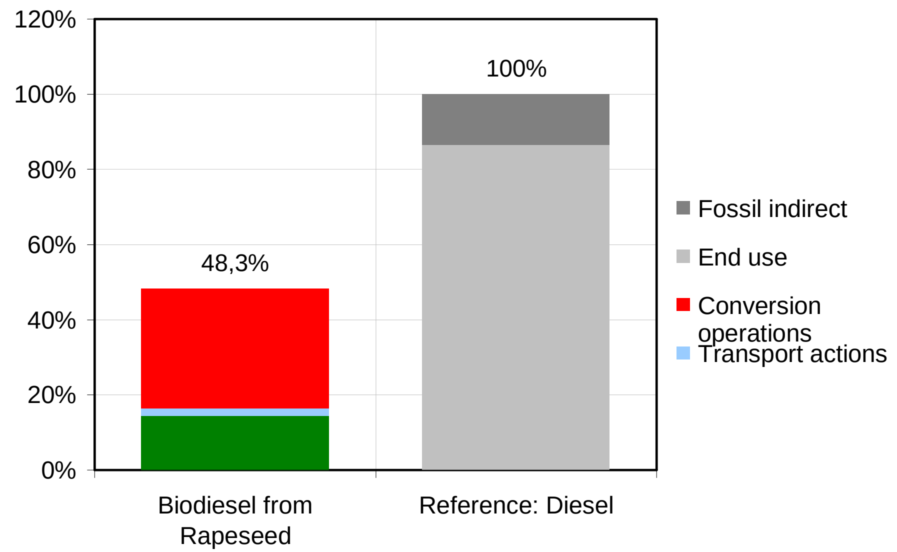
Biofuels greenhouse gas calculator

NL Agency
Ministry of Economic Affairs

GHG emissions [% of reference]



Energy use [% of reference]



BIOGRACE
Harmonised Calculations of Biofuel Greenhouse Gas Emissions in Europe

Intelligent Energy Europe

Dutch GHG tool

Biofuel	Biodiesel
Feedstock	Rapeseed
Process	-
Reference	Diesel

Return to overview results | Return to input

	Absolute Numbers (including allocation)					Relative contribution (including allocation)			
	Energy use [MJ fossil fuel/ MJ biofuel]	Emission CO2 [kg CO2/ MJ biofuel]	Emission N2O [kg CO2-eq/ MJ biofuel]	Emission CH4 [kg CO2-eq/ MJ biofuel]	Emission GHG [kg CO2-eq/ MJ biofuel]	Energy use [%]	Emission CO2 [%]	Emission N2O [%]	Emission CH4 [%]
Feedstock production									
Diesel	0,047	3,555	0,00E+00	0,00E+00	3,555	8,4%	6,9%	0,0%	0,0%
N fertilizer	0,092	5,319	5,370	0,376	11,065	16,5%	10,3%	10,4%	0,7%
CaO fertilizer	5,13E-04	0,031	1,41E-03	1,29E-03	0,034	0,1%	0,1%	0,0%	0,0%
K2O fertilizer	6,55E-03	0,363	2,47E-03	0,024	0,390	1,2%	0,7%	0,0%	0,0%
P2O5 fertilizer	7,02E-03	0,445	7,03E-03	0,014	0,466	1,3%	0,9%	0,0%	0,0%
Pesticides	4,52E-03	0,166	8,38E-03	9,89E-03	0,185	0,8%	0,3%	0,0%	0,0%
Seeding material - rapeseed	6,46E-04	0,034	0,024	1,72E-03	0,060	0,1%	0,1%	0,0%	0,0%
Field N2O emissions	0,00E+00	0,00E+00	12,575	0,00E+00	12,575	0,0%	0,0%	24,3%	0,0%
Direct Land Use Change	-	0,00E+00	-	-	0,00E+00	-	0,0%	-	-
Total Feedstock production	**0,159**	**9,914**	**17,989**	**0,427**	**28,331**	**28,4%**	**19,2%**	**34,8%**	**0,8%**
Allocation burden of this and previous steps to main product Raw rapeseed				100,0%					
Allocation burden of this and previous steps to by-product Raw rapeseed				0,0%					
Allocation burden of this step to Biodiesel at end-of-chain				58,6%					
Feedstock drying									
Diesel	2,13E-04	0,016	0,00E+00	0,00E+00	0,016	0,0%	0,0%	0,0%	0,0%
Electricity (EU-mix, LV)	8,51E-03	0,377	5,05E-03	0,021	0,403	1,5%	0,7%	0,0%	0,0%
Total Feedstock drying	**8,72E-03**	**0,393**	**5,05E-03**	**0,021**	**0,419**	**1,6%**	**0,8%**	**0,0%**	**0,0%**
Allocation burden of this and previous steps to main product Dried rapeseed				100,0%					
Allocation burden of this and previous steps to by-product Dried rapeseed				0,0%					
Allocation burden of this step to Biodiesel at end-of-chain				58,6%					
Transport feedstock									
Truck for dry product (Diesel)	2,29E-03	0,173	0,00E+00	2,43E-04	0,173	0,4%	0,3%	0,0%	0,0%
Total Transport feedstock	**2,29E-03**	**0,173**	**0,00E+00**	**2,43E-04**	**0,173**	**0,4%**	**0,3%**	**0,0%**	**0,0%**

BIOGRACE
Harmonised Calculations of Biofuel Greenhouse Gas Emissions in Europe

Intelligent Energy Europe

Dutch GHG tool

DIRECT LAND USE CHANGE CALCULATION

Return to input

1. Standard Soil Carbon stock in mineral soil (SOC_{ST})

Climate region	Boreal	See figure 1	The blue fields are drop down boxes.
Soil type	High activity clay soils	See figure 3 & 2	
	Result	SOC_{ST} 68	ton C / ha

2. Factors reflecting the difference in Soil Organic Carbon (SOC) compared to the Standard Soil Organic Carbon (SOC_{ST})

Actual land use

Default=Calculate with standard values: Default
User = Own calculation incl. measured value

Type of land	Cropland	See tables 3, 6 and 8	
Climate region	Temperate/Boreal, dry		
Land use F_{LU}	Cultivated		0,8
Management F_{MG}	Full-tillage		1
Input F_I	Low		0,95
	Result	SOC_A	51,68 ton C / ha

Reference land use

Default=Calculate with standard values: Default
User = Own calculation incl. measured value

Type of land	Cropland	See tables 3, 6 and 8	
Climate region	Temperate/Boreal, dry		
Land use F_{LU}	Cultivated		0,8
Management F_{MG}	Full-tillage		1
Input F_I	Low		0,95
	Result	SOC_{ref}	51,68 g C / ha

3. Above and below ground vegetation (Cveg)

Actual land use

Default=Calculate with standard values: Default
User = Own calculation incl. measured value

Type of land	Cropland (General)
Domain	
Climate region	
Ecological zone	
Continent	
Crop type	
Result	$C_{VEG,A}$ 0 ton C / ha

Reference land use

Default=Calculate with standard values: Default
User = Own calculation incl. measured value

Type of land	Forest 10-30% canopy cover, excl plantations
Domain	Temperate
Climate region	
Ecological zone	Temperate continental forest
Continent	Asia, Europe (<= 20 y)
Crop type	
Result	$C_{VEG, ref}$ 2 ton C / ha

4. Bonus (eb) for cultivation on restored degraded land under the conditions provided for in point 8 of Annex V of directive.

Bonus: No

No = 0 g CO_2/MJ
Yes = -29 g CO_2/MJ

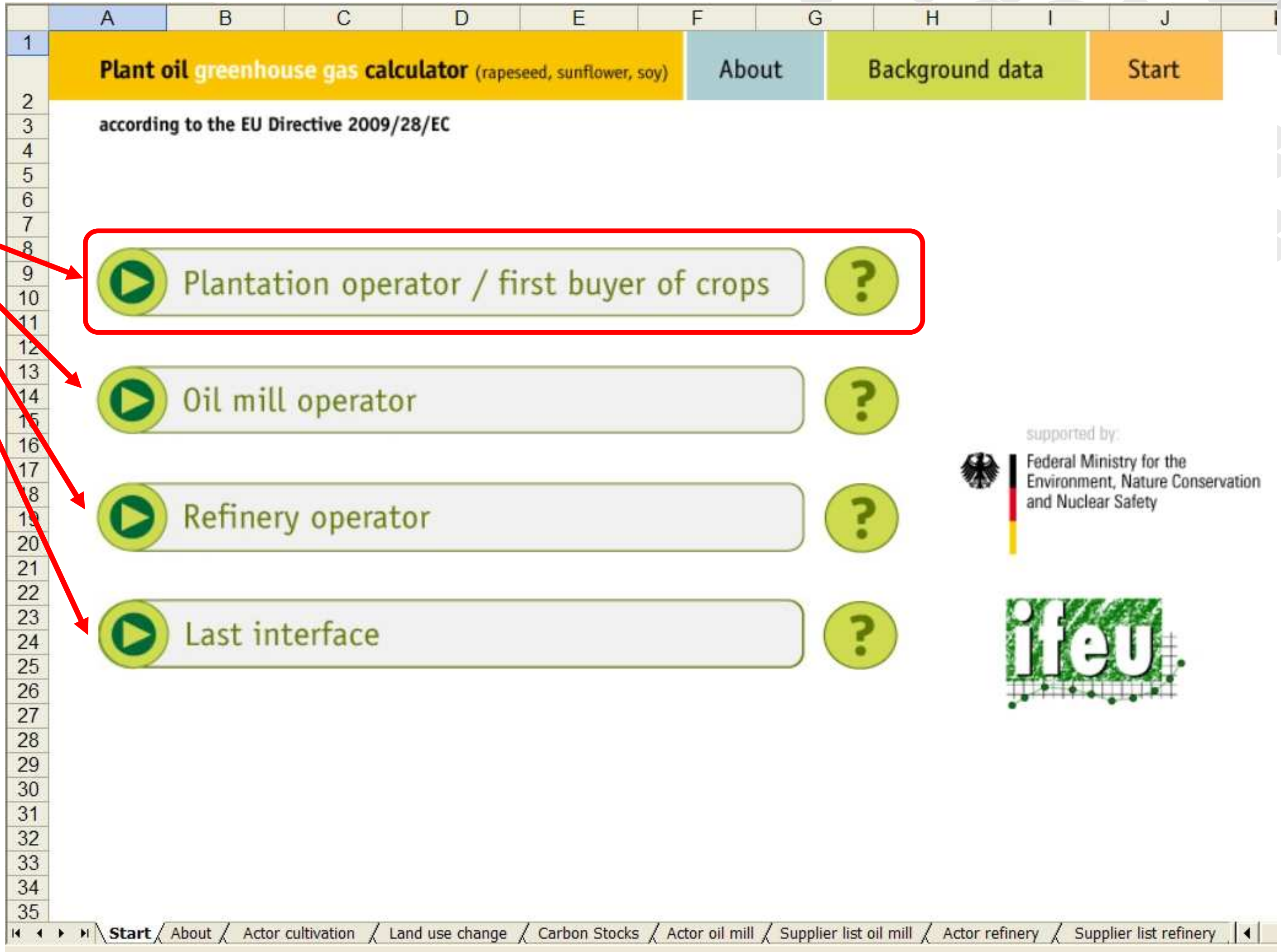
Total results

Result: CO_2 emission caused by direct land use change 8,5625592 **g CO_2/MJ biofuel**

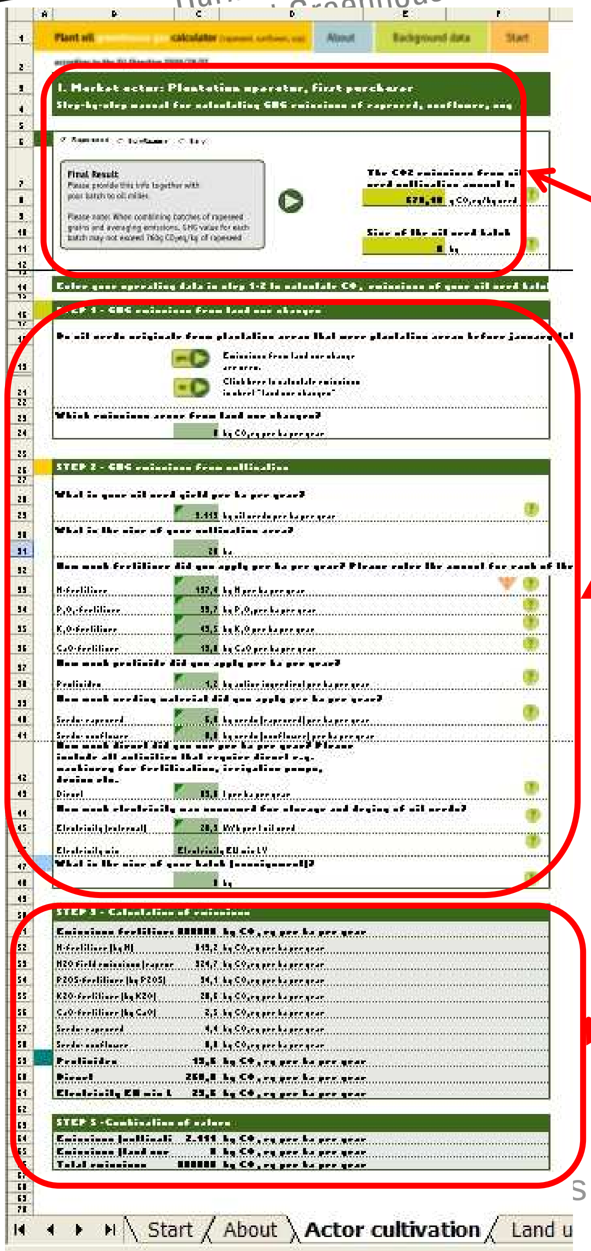
Calculate Results — Re-calculate the results if you changed the values here or at the input page.

German GHG tool

- 4 actor-specific calculation sheets



German GHG tool



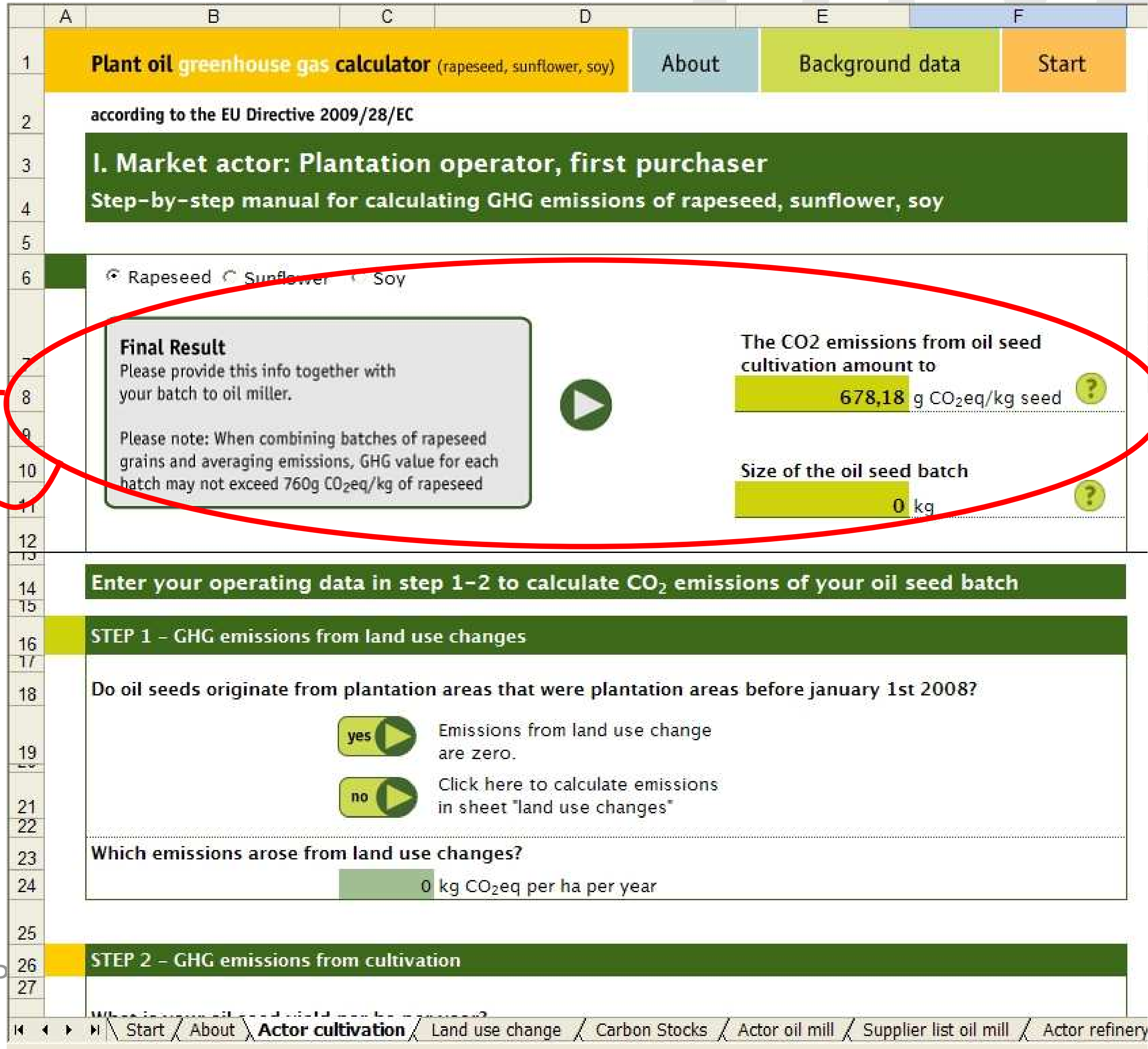
- One sheet for each economic operator
- Box: Results
- Box: step-by-step manual
- Box: Calculation of emissions

German GHG tool – Cultivation

- GHG result & batch size: data to be delivered to oil miller

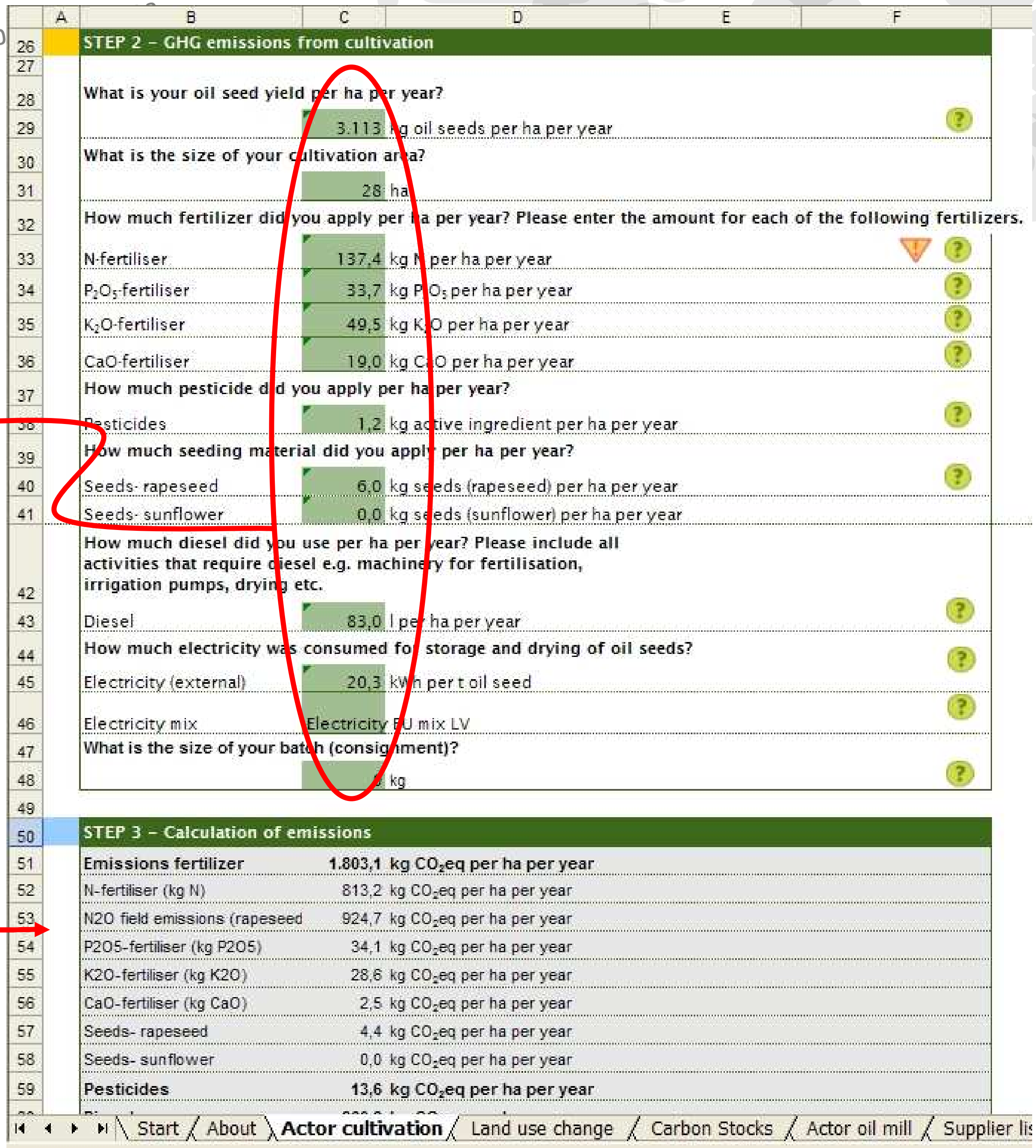
GHG result

- per kg seed
- per MJ biodiesel (BioGrace)



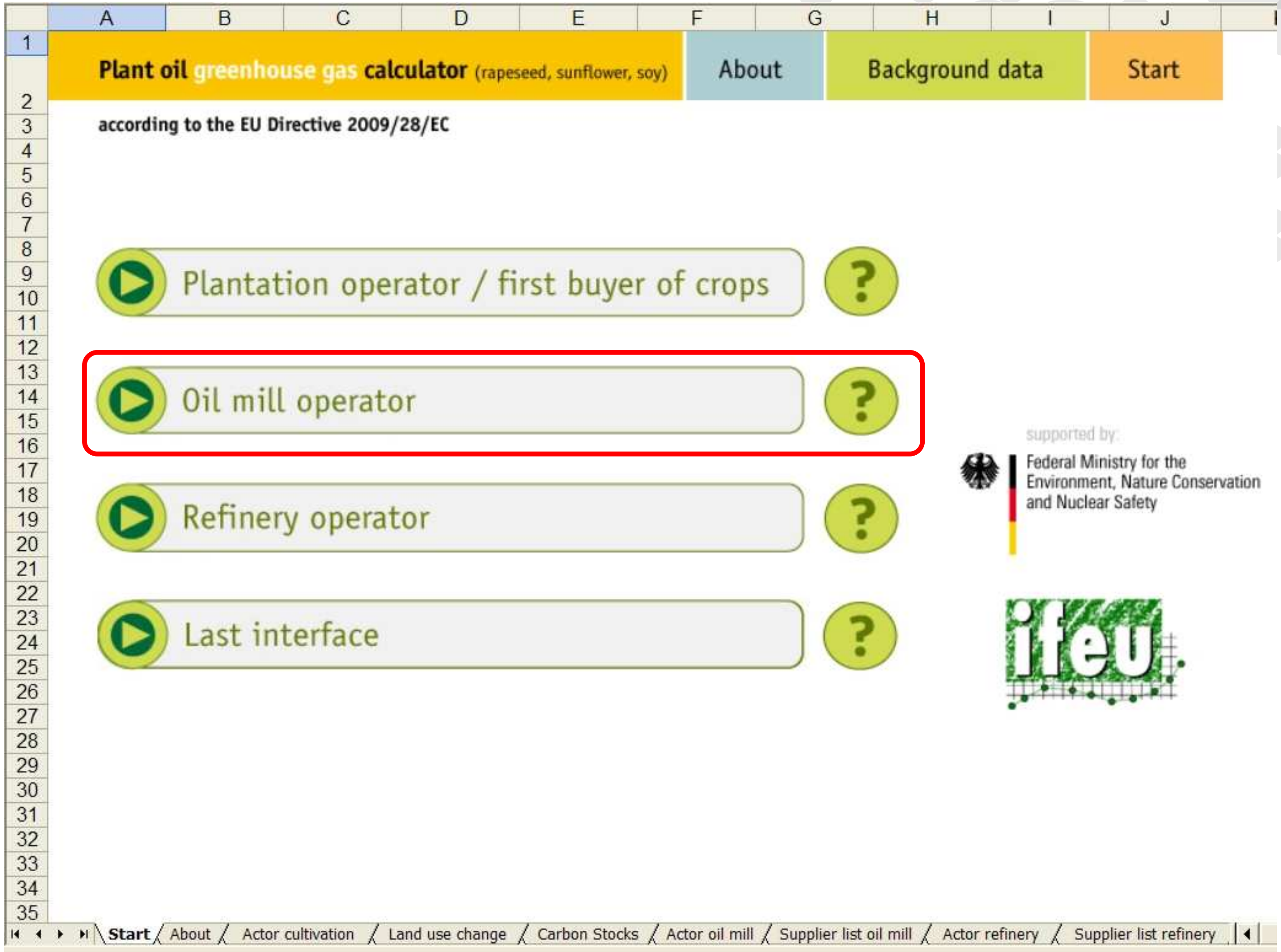
German GHG tool – Cultivation

- Step-by-step manual asking for actual data from producer
- GHG calculations

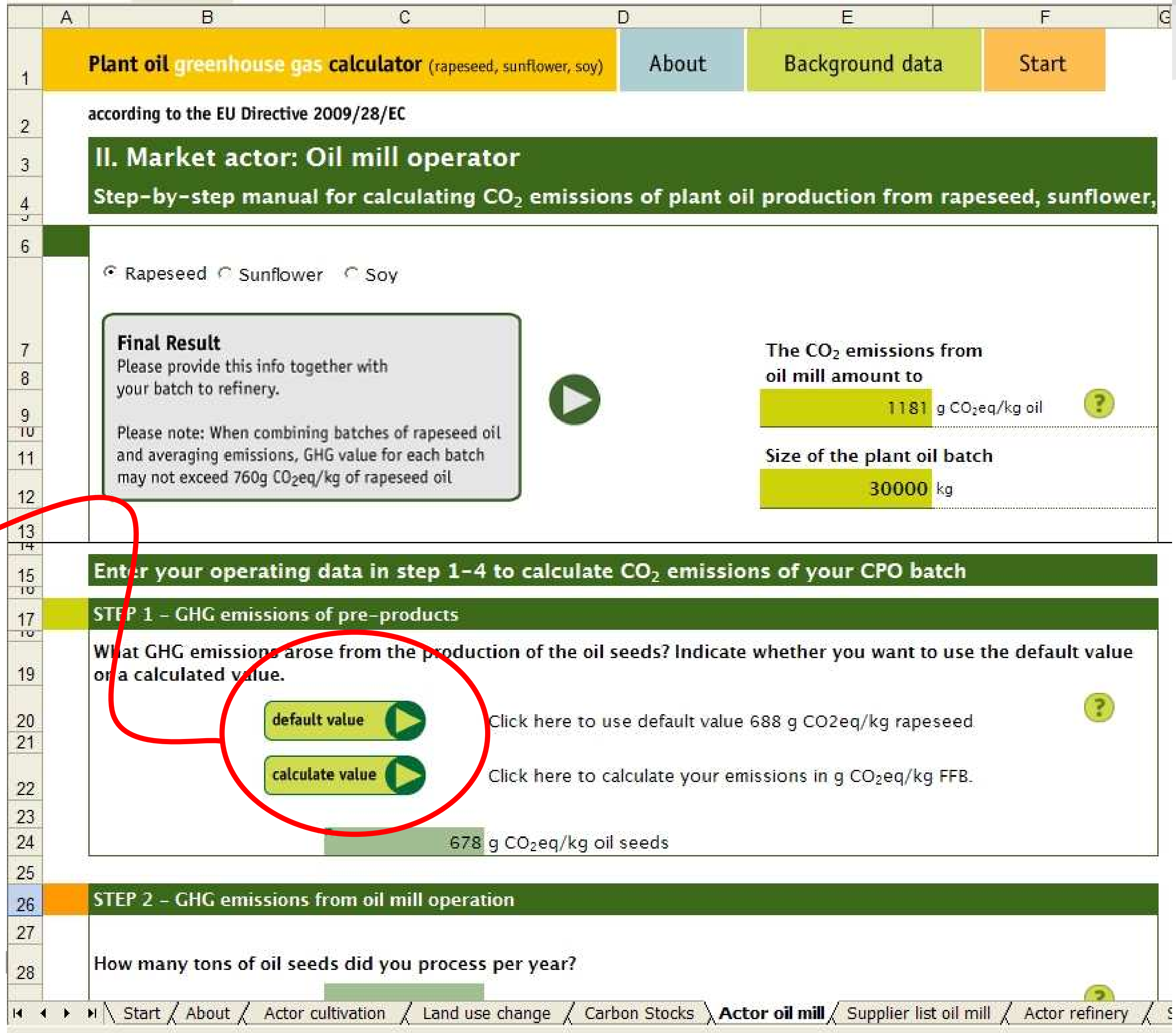


	B	C	D
26	STEP 2 – GHG emissions from cultivation		
28	What is your oil seed yield per ha per year?		
29		3.113	kg oil seeds per ha per year
30	What is the size of your cultivation area?		
31		28	ha
32	How much fertilizer did you apply per ha per year? Please enter the amount for each of the following fertilizers.		
33	N-fertiliser	137,4	kg N per ha per year
34	P_2O_5-fertiliser	33,7	kg P_2O_5 per ha per year
35	K_2O-fertiliser	49,5	kg K_2O per ha per year
36	CaO-fertiliser	19,0	kg CaO per ha per year
37	How much pesticide did you apply per ha per year?		
38	Pesticides	1,2	kg active ingredient per ha per year
39	How much seeding material did you apply per ha per year?		
40	Seeds- rapeseed	6,0	kg seeds (rapeseed) per ha per year
41	Seeds- sunflower	0,0	kg seeds (sunflower) per ha per year
42	How much diesel did you use per ha per year? Please include all activities that require diesel e.g. machinery for fertilisation, irrigation pumps, drying etc.		
43	Diesel	83,0	l per ha per year
44	How much electricity was consumed for storage and drying of oil seeds?		
45	Electricity (external)	20,3	kWh per t oil seed
46	Electricity mix	Electricity EU mix LV	
47	What is the size of your batch (consignment)?		
48		0	kg
50	STEP 3 – Calculation of emissions		
51	**Emissions fertilizer**	**1.803,1**	**kg CO_2eq per ha per year**
52	N-fertiliser (kg N)	813,2	kg CO_2eq per ha per year
53	N2O field emissions (rapeseed	924,7	kg CO_2eq per ha per year
54	P2O5-fertiliser (kg P2O5)	34,1	kg CO_2eq per ha per year
55	K2O-fertiliser (kg K2O)	28,6	kg CO_2eq per ha per year
56	CaO-fertiliser (kg CaO)	2,5	kg CO_2eq per ha per year
57	Seeds- rapeseed	4,4	kg CO_2eq per ha per year
58	Seeds- sunflower	0,0	kg CO_2eq per ha per year
59	**Pesticides**	**13,6**	**kg CO_2eq per ha per year**

German GHG tool



German GHG tool – Oil miller



Choice between:

- actual value
- disaggregated default value

German GHG tool – Oil miller

“Saldierung”
Mixing batches and averaging emissions

Plant oil greenhouse gas calculator (rapeseed, sunflower, soy) | About | Background data | Start

according to the EU Directive 2009/28/EC

Mixing oil seed batches from several suppliers and averaging GHG emissions

Overall quantity metric tonnes	Overall GHG value g CO_2eq/kg oilseed
19	618,4210526

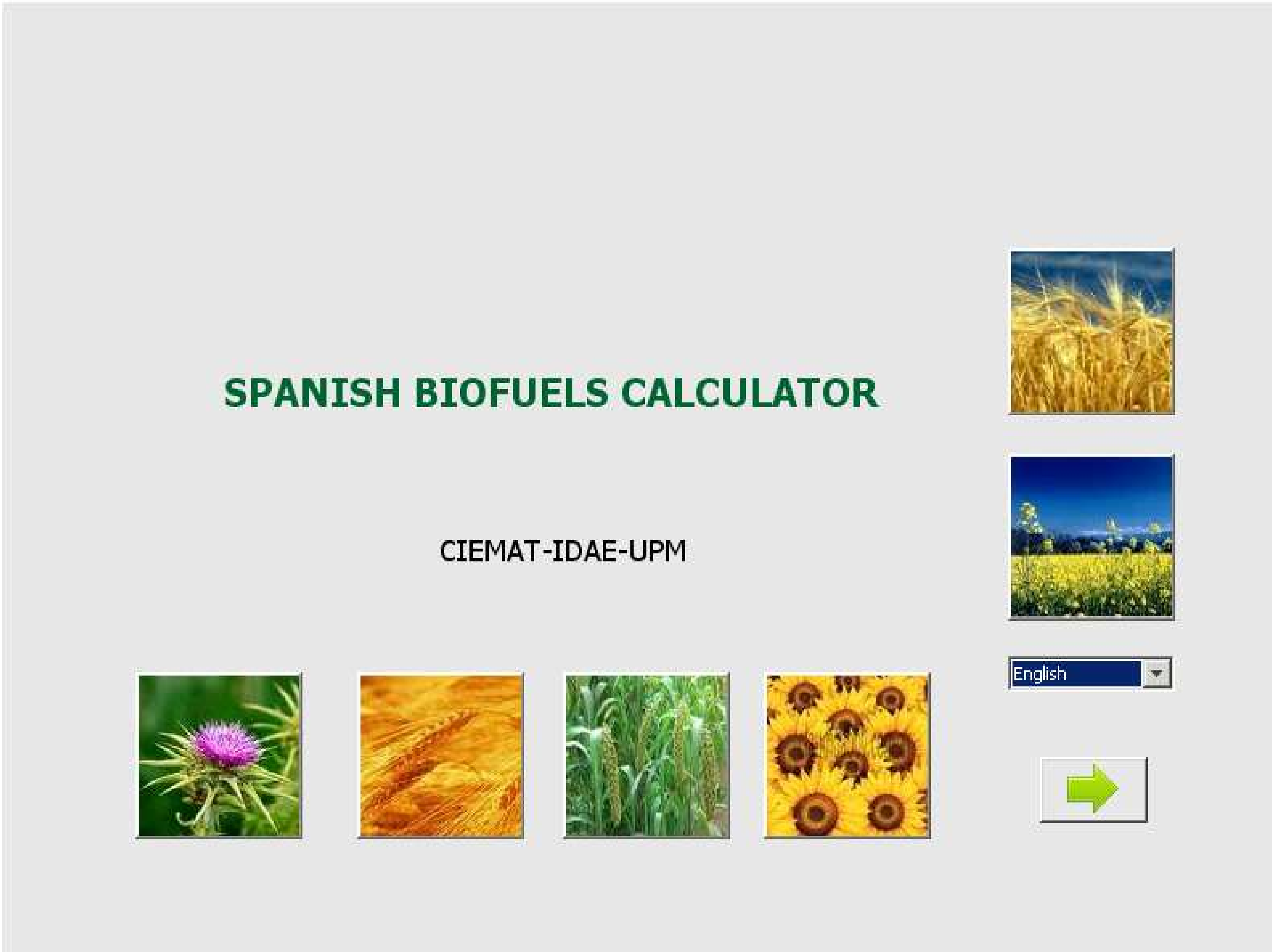
confirm value and back

Supplier#	Plantation name	Oil seed quantitity metric tonnes	GHG value g CO_2eq/kg oilseed
1	Betrieb 1	4	750
2	Betrieb 2	5	650
3	Betrieb 3	10	550
4			
5			
6			
7			
8			
9			
10			
11			
12			
13			
14			
15			
16			
17			
18			
19			
20			

fill in the information delivered by your suppliers

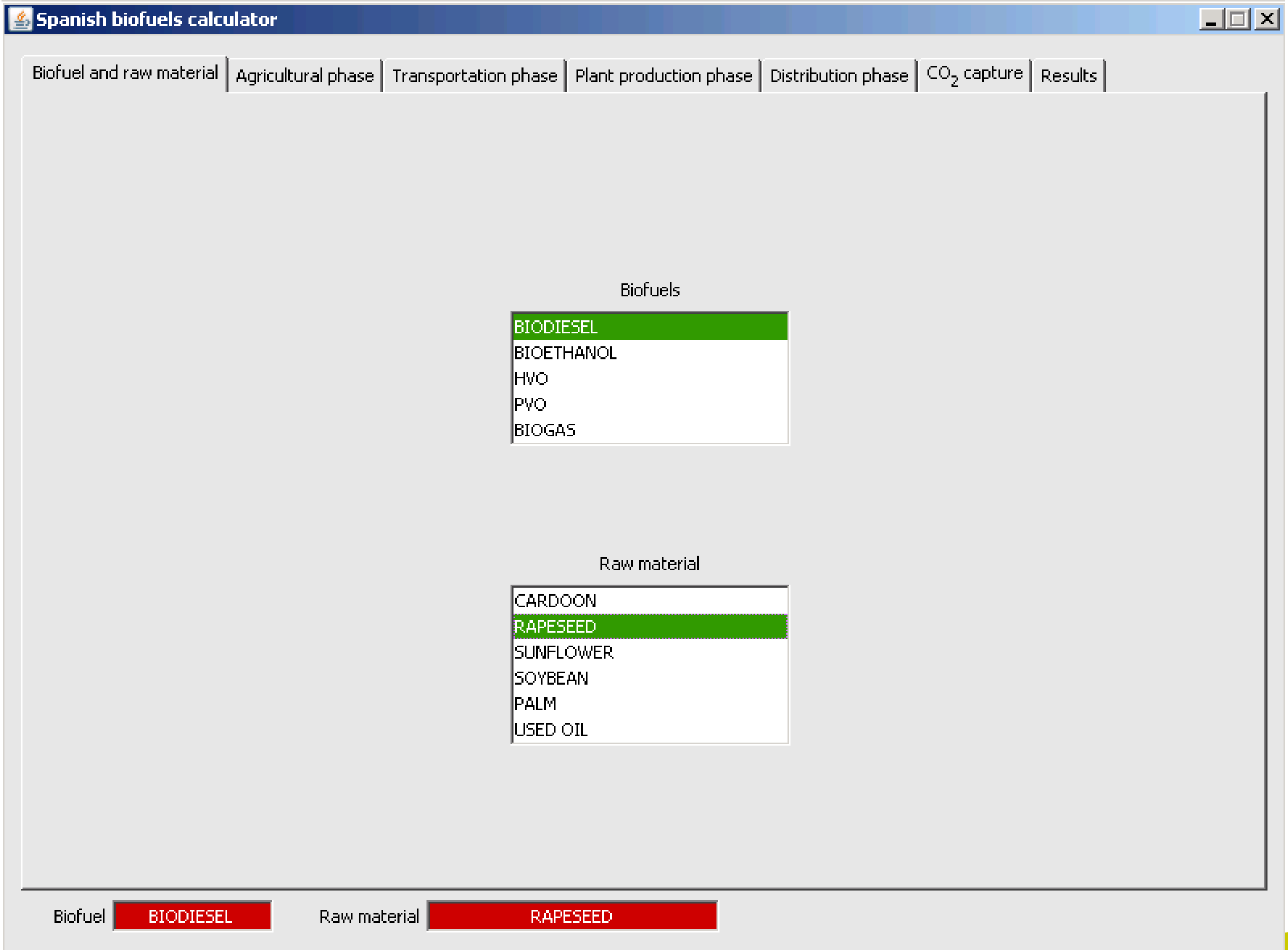
Start / About / Actor cultivation / Land use change / Carbon Stocks / Actor oil mill / **Supplier list oil mill** / Actor refinery / Supplier list refinery

Spanish GHG tool



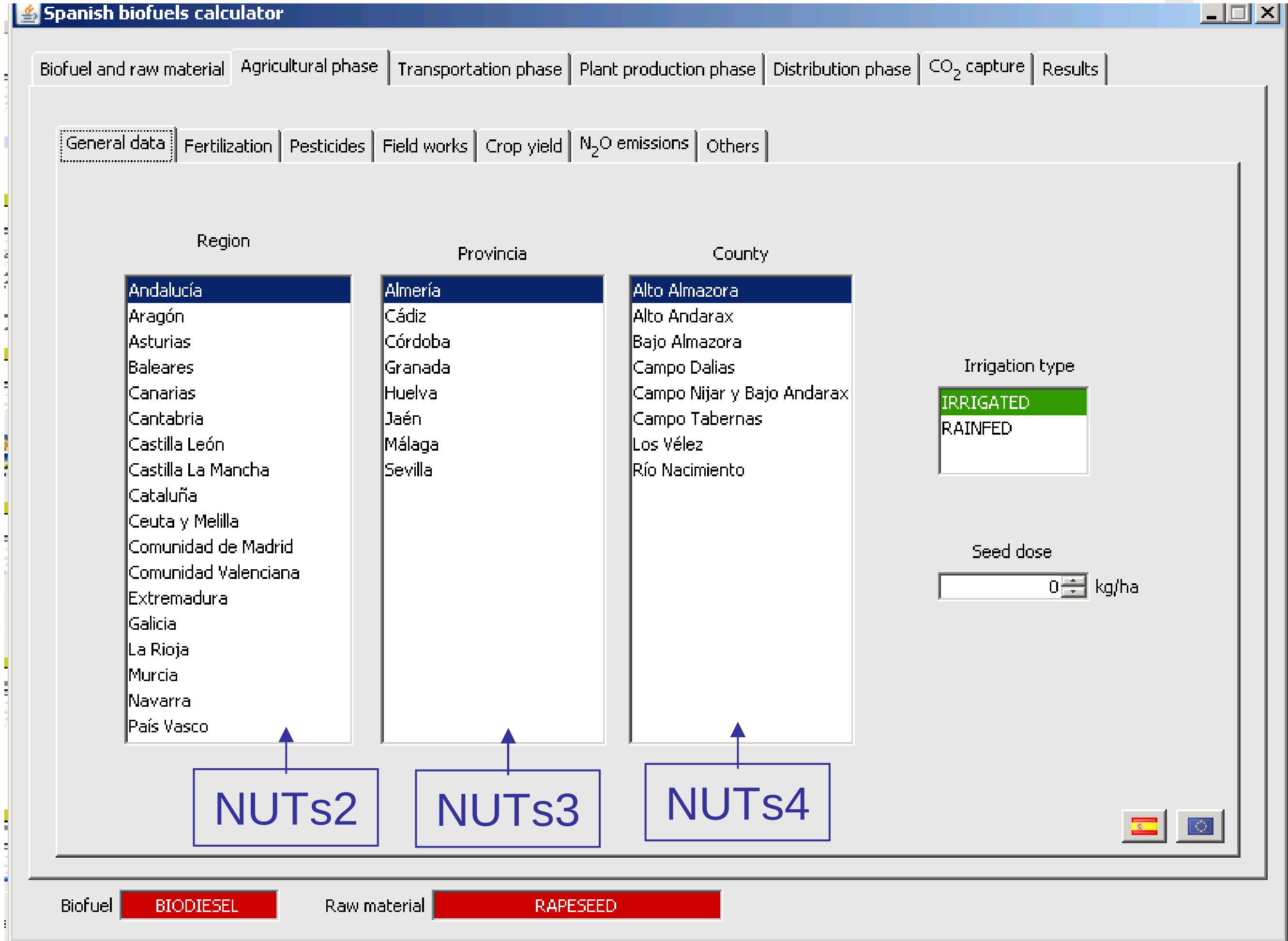
Spanish GHG tool

Biofuel and raw material selection screen



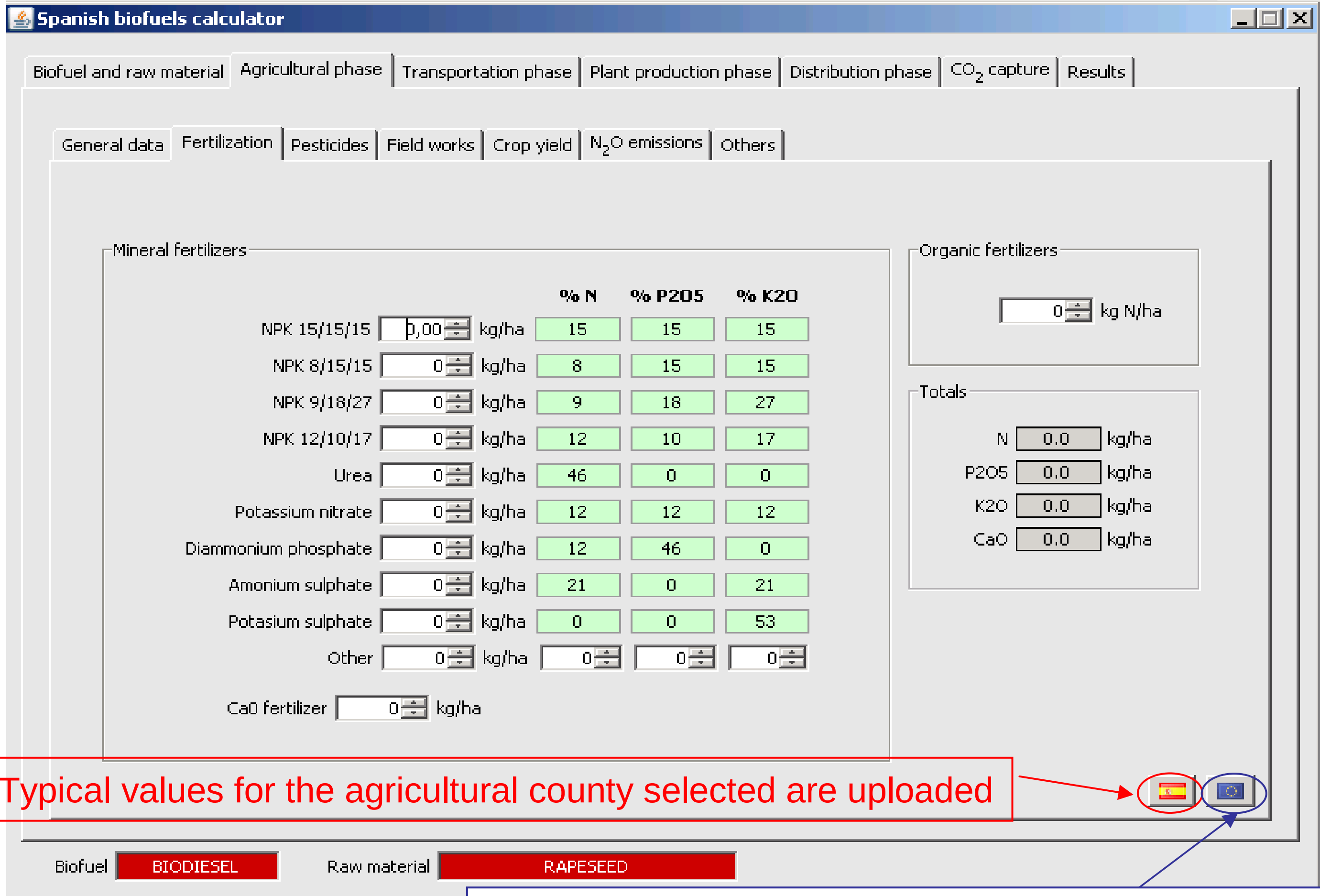
Spanish GHG tool

Agricultural county selection screen



Spanish GHG tool

Fertilization data input screen

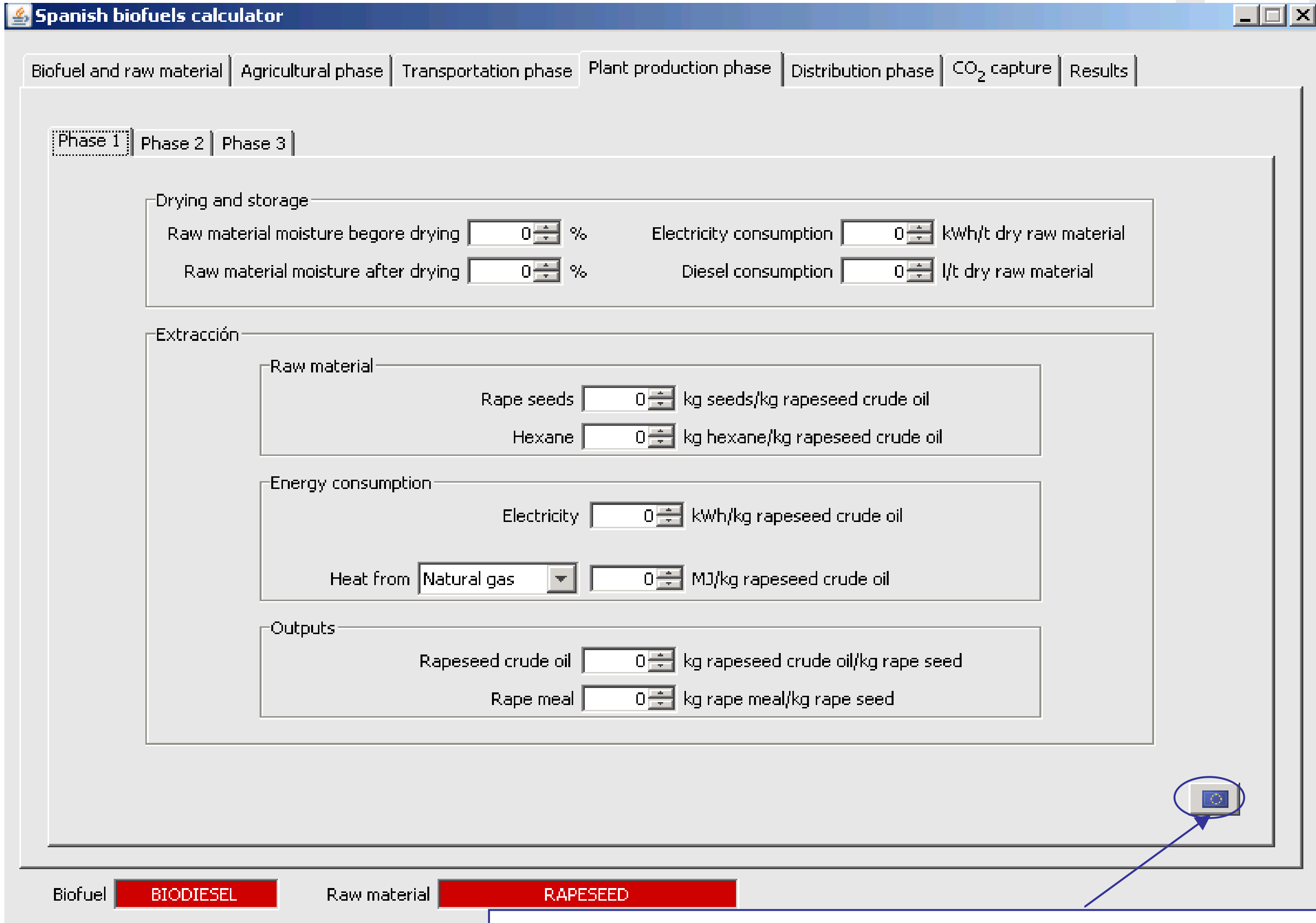


Typical values for the agricultural county selected are uploaded

Values to reproduce the default values of the RED are uploaded

Spanish GHG tool

Transformation data input screen



Values to reproduce the default values of the RED are uploaded

BIOGRACE
Harmonised Calculations of Biofuel Greenhouse Gas Emissions in Europe

Intelligent Energy Europe

Spanish GHG tool

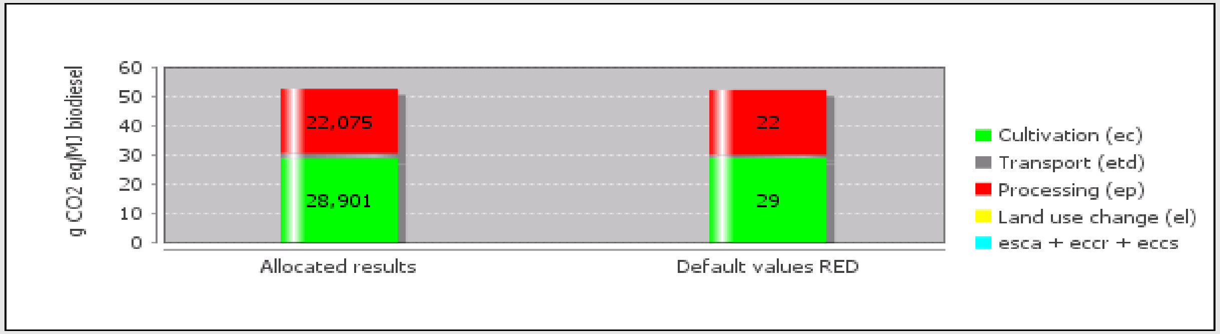
Results screen

Spanish biofuels calculator

Biofuel and raw material | Agricultural phase | Transportation phase | Plant production phase | Distribution phase | CO_2 capture | Results

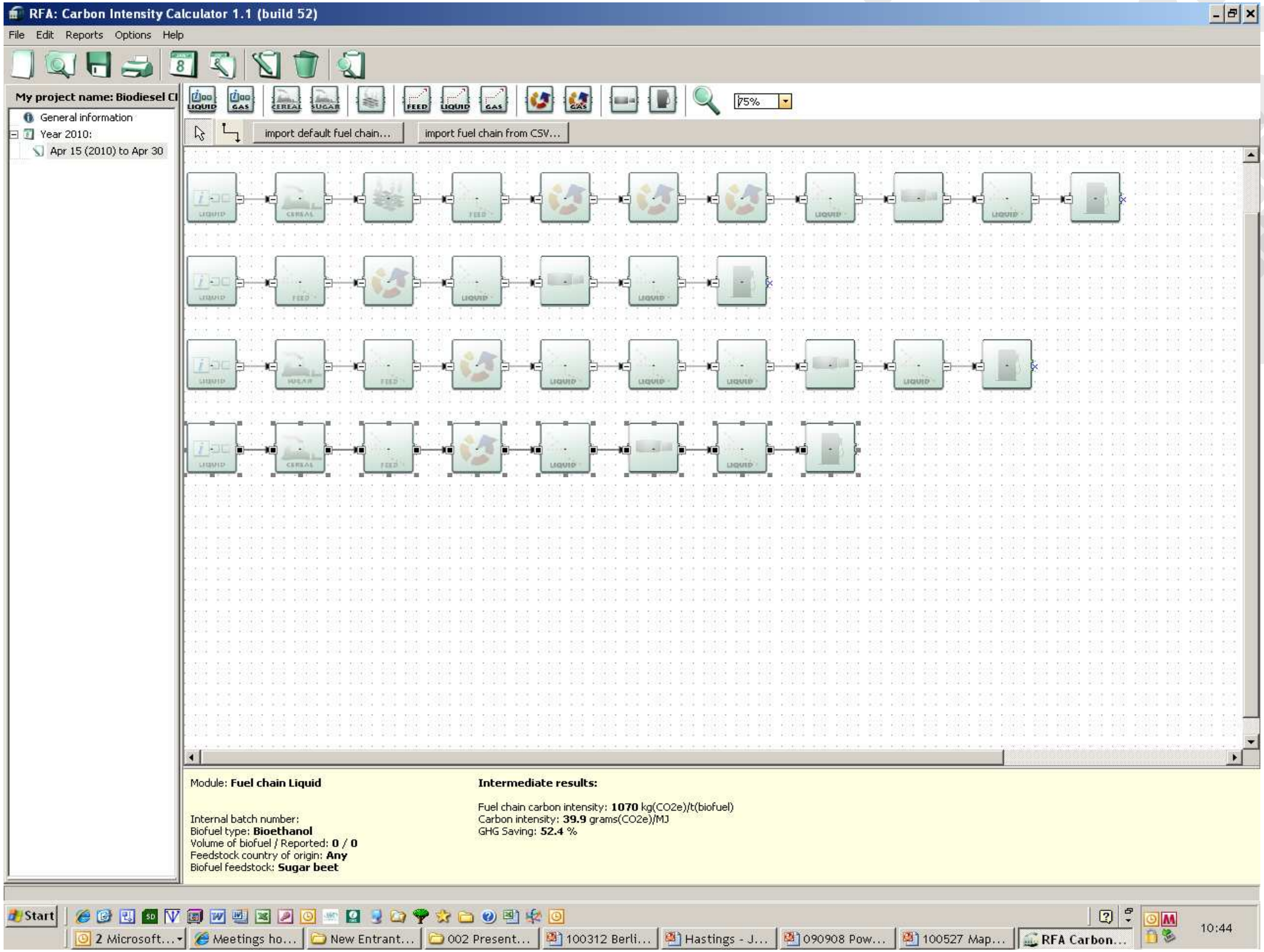
Cultivation of raw materials e_{ec} | Transport and distribution phases e_{td} | Transformation phase e_p - e_{ee} | Totals

All results in CO_2 eq g/MJ biodiesel	Non-allocated results	Allocation factor (%)	Allocated results	Emission reduction (%)	Deafault values RED Annex V.D
Cultivation e_c	49,33	58,59	28,9		29
Transport e_{td}	1,64		1,53		1
Processing e_p	25,5		22,08		22
Land use change e_l	0	58,59	0		0
$e_{sca} + e_{ccr} + e_{ccs}$	0	100	0		0
TOTALS	76,47		52,51	37,34	52



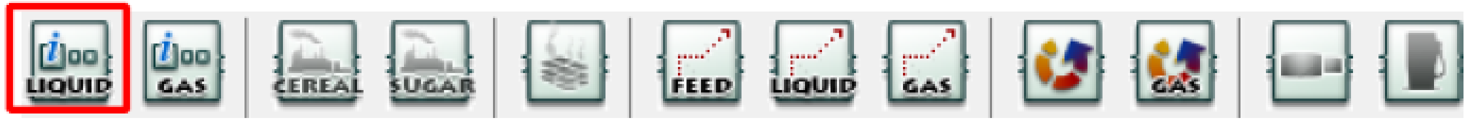
Biofuel: BIODIESEL | Raw material: RAPESEED

UK GHG tool


RFA: Carbon Intensity Calculator 1.1 (build 52)
File Edit Reports Options Help
My project name: Biodiesel Cl
General information
Year 2010:
Apr 15 (2010) to Apr 30
import default fuel chain...
import fuel chain from CSV...
75%
Module: Fuel chain Liquid
Internal batch number:
Biofuel type: Bioethanol
Volume of biofuel / Reported: 0 / 0
Feedstock country of origin: Any
Biofuel feedstock: Sugar beet
Intermediate results:
Fuel chain carbon intensity: 1070 kg(CO2e)/t(biofuel)
Carbon intensity: 39.9 grams(CO2e)/MJ
GHG Saving: 52.4 %
Start
RFA Carbon...
10:44

UK GHG tool

7.2 Fuel chain – Liquid



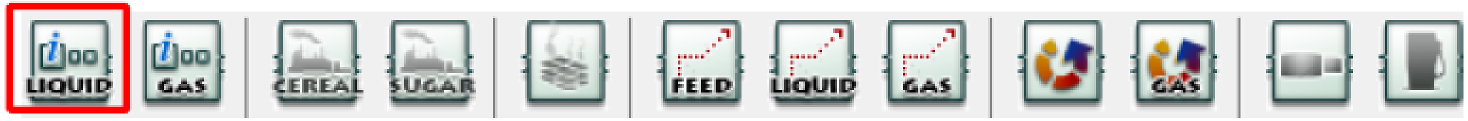
Basic data	
Module description	A brief description of the module. This field is optional.
Details and links to verification evidence	Any further details can be added here, including, for example links to any evidence which supports the actual data used within this module. This field is optional.
Internal batch number	A batch number for your own reference can be entered here. This field is optional.
Fuel type produced	The biofuel type of this batch / fuel chain. This field is compulsory. This field can only be changed if no modules follow the 'Fuel chain – Liquid' module.
Country	The country in which the feedstock was produced (NOT necessarily the country in which the biofuel was produced). This field is compulsory ('Unknown' can be selected if relevant). This field can only be changed if no modules follow the 'Fuel chain – Liquid' module.
Biofuel feedstock	The type of feedstock from which the biofuel was produced. This field is compulsory ('Unknown' can be selected if relevant). This field can only be changed if no modules follow the 'Fuel chain – Liquid' module.

BIOGRACE
Harmonised Calculations of
Biofuel Greenhouse Gas Emissions in Europe

Intelligent Energy Europe

UK GHG tool

7.2 Fuel chain – Liquid



Quantity of fuel	The quantity of biofuel in this batch (measured in litres) – this is the quantity of fuel the software enters into the monthly CSV report which can be uploaded to the RFA Operating System.
Quantity of fuel recorded in the RFA Operating System	If you make any adjustments to fuel quantities recorded on the RFA Operating System after uploading a monthly CSV report, the new quantities can be recorded in this field (measured in litres). Annual reports can only be prepared if fuel quantities are recorded in this field.
Fuel chain default value	This field shows the appropriate fuel chain default value, based on the data you supplied on fuel type, feedstock and country of origin.
Social and Environmental	
Land use on 01 Jan 2008	The land use, on 1st January 2008, for the land on which the biofuel feedstock was grown. Definitions of the land use are given in the Technical Guidance for RTFO year 3 Part 1 Annex H.
Standard	The sustainability standard to which the reported feedstock was produced – see Section 3.3 of the Technical Guidance for RTFO year 3 Part 1 for further details.
Social level	The 'Social level' achieved by the sustainability standard selected. This field will generally not need to be changed.

BIOGRACE

Harmonised Calculations of Biofuel Greenhouse Gas Emissions in Europe

Steps towards further harmonisation of biofuel GHG calculations

Rémy LAURANSON
BIO IS
Public workshop Paris
May 19, 2011

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1. Introduction
2. Recognition as a voluntary certification scheme
3. Making actual calculation requires some rules
4. Future actions

Introduction

- Objectives of project will be met:
  - Current GHG tool makes transparent how RED Annex V default values were calculated
  - BioGrace list of standard values is important step towards harmonisation of European biofuel GHG calculations
  - The BioGrace tool plus national tools facilitate stakeholders to make actual calculations
  - BioGrace results are widely disseminated

- Next ambition of BioGrace is to:
  1. Support stakeholders in meeting (RED & FQD) biofuels sustainability criteria
  2. Clarify role of BioGrace compared to other (existing/under development) voluntary certification schemes

Contents

Recognition as a voluntary cert. 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 submit GHG tool to EC for recognition as a voluntary scheme

Recognition as a voluntary cert. scheme

- BioGrace voluntary scheme 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

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

Contents

Making actual calculation requires 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 topics are not yet 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
  - We expect some coordination of Commission

Changing starting values

- When changing a starting value into an actual value, all other starting values in that step should be changed into actual values as well.

Extraction of oil

Yield		
Crude vegetable oil	0,6125	MJ_{Oil} / $MJ_{Rapeseed}$
Co-product Rapeseed cake	0,3875	$MJ_{Rapeseed\ cake}$ / MJ_{Rapese}
Energy consumption		
Electricity EU mix MV	0,0118	MJ / MJ_{Oil}
Steam (from NG boiler)	0,0557	MJ / MJ_{Oil}
NG Boiler		
CH_4 and N_2O emissions from NG boiler		
Natural gas input / MJ stean	1,111	MJ / MJ_{Steam}
Natural gas (4000 km, EU M	0,062	MJ / MJ_{Oil}
Electricity input / MJ steam	0,020	MJ / MJ_{Steam}
Electricity EU mix MV	0,001	MJ / MJ_{Oil}
Chemicals		
n-Hexane	0,0043	MJ / MJ_{Oil}

Refining of vegetable oil

Yield		
Rapeseed oil	0,960	MJ_{Oil} / MJ_{Oil}
Energy consumption		
Electricity EU mix MV	0,0008	MJ / MJ_{Oil}
Steam (from NG boiler)	0,0115	MJ / MJ_{Oil}
NG Boiler		
CH_4 and N_2O emissions from NG boiler		
Natural gas input / MJ stean	1,111	MJ / MJ_{Steam}
Natural gas (4000 km, EU M	0,013	MJ / MJ_{Oil}
Electricity input / MJ steam	0,020	MJ / MJ_{Steam}
Electricity EU mix MV	0,000	MJ / MJ_{Oil}
Chemicals		
Fuller's earth	0,0002	kg / MJ_{Oil}

All results in g $CO_{2,eq}$ / MJ_{FAME}	Allocated results	Total
Cultivation e_{ec}		28,9
Cultivation of rapeseed	28,49	
Rapeseed drying	0,42	
Processing e_p		21,7
Extraction of oil	3,83	
Refining of vegetable oil	1,02	
Esterification	16,84	
Transport e_{td}		1,4
Transport of rapeseed	0,17	
Transport of FAME	0,82	
Filling station	0,44	
Land use change e_l	0,0	0,0
e_{sca} + e_{ccr} + e_{ccs}	0,0	0,0
Totals		**52,0**

Cut off criteria

- All emissions from processes and products used and associated with the system the economic operator has defined must be included in the GHG calculation. However, if the contribution of that input or process to the total emissions of the biofuel pathway is lower than 0.1 g $CO_{2,eq}$/MJ biofuel, it may be excluded.

Mass or energy threshold		
0,000005	kg/MJ	(this is equal to 0,005 g/MJ)
0,0002	MJ/MJ	(this is equal to 0,2 kJ/MJ)
10	MJ ha^{-1} $year^{-1}$	
0,3	kg ha^{-1} $year^{-1}$	

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Future actions

1. Update in 2011
- RED Annex V default values might change
  - When Commission updates Annex V in 2011
- BioGrace will update tool and will update standard values

2. Apply BioGrace approach to electricity/heat from biomass
- Harmonise GHG calculations for bio-energy
- Different to biofuels: sustainability not mandated by directive

3. Ensure continuation of work after March 2012

Thank you for your attention

Intelligent Energy Europe

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