BIOGRACE

Harmonised Calculations of Biofuel Greenhouse Gas Emissions in Europe

BioGrace – Harmonising calculations of biofuel GHG emissions in Europe

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BIOENERGY 2020+
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Renewable Energy Directive (RED)

Sustainability criteria for biofuels

- Minimum GHG emission savings (Art. 17.2)
  - 35%
  - for installations that were in operation on 23 January 2008: binding from 1 April 2013
  - 2017 50%
  - 2018 60% for new installations
- Economic operators may use (Art. 19.1)
  - default values
  - actual values calculated according to Annex V.C
  - sum of actual value and disaggregated default value
- Independent auditors must check information (Art. 18.3)
- Can be part of voluntary certification schemes (Art. 18.4)

RED Annex V.a

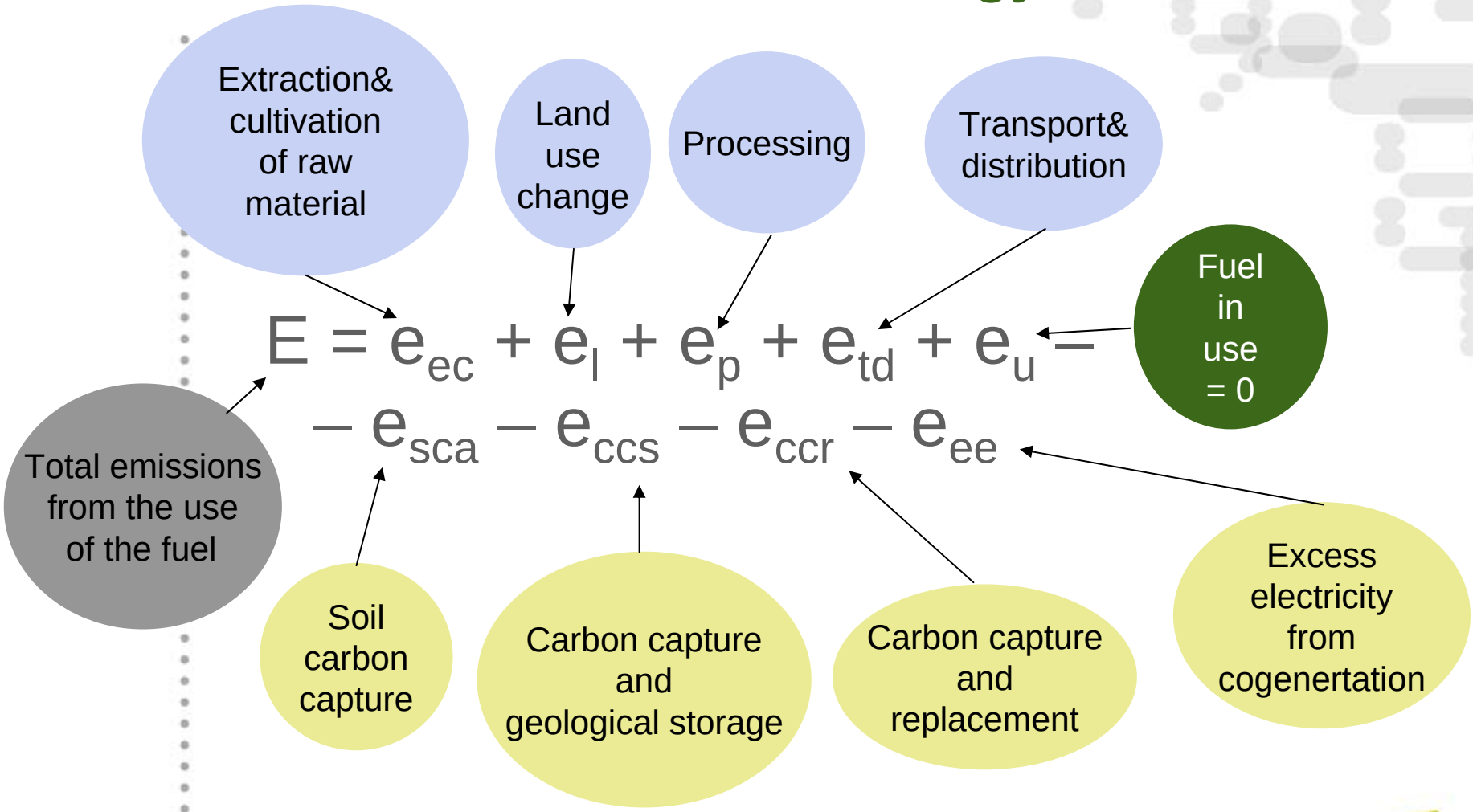
A. *Typical and default values for biofuels if produced with no net carbon emissions from land-use change*

Biofuel production pathway	Typical greenhouse gas emission saving	Default greenhouse gas emission saving
sugar beet ethanol	61 %	52 %
wheat ethanol (process fuel not specified)	32 %	16 %
wheat et… …P plant)	32 %	16 %
…nventional	45 %	34 %
	53 %	47 %
	69 %	69 %
…as as	56 %	49 %
	71 %	71 %
the part … …thyl-tertio-butyl-ether (ETBE)	Equal to that of the ethanol production pathway used	
the part from renewable sources of tertiary-amyl-ethyl-ether (TAEE)	Equal to that of the ethanol production pathway used	
rape seed biodiesel	45 %	38 %
sunflower biodiesel	58 %	51 %
soybean biodiesel		31 %
palm oil biodiesel (process not specified)		19 %
palm oil biodiesel (process with me…		…6 %
waste vegetable or animal (*) oil b…		… %
hydrotreated vegetable oil from ra…		… %
hydrotreated vegetable oil from sun…		…2 %
hydrotreated vegetable oil from palm oil …		26 %
hydrotreated vegetable oil from palm oil (proces… ane capture at oil mill)		65 %
pure vegetable oil from rape seed	58 %	57 %
biogas from municipal organic waste as compressed natural gas	80 %	73 %
biogas from wet manure as compressed natural gas	84 %	81 %
biogas from dry manure as compressed natural gas	86 %	82 %

Ethanol form sugar beet
Typical savings: 61%
Default value: 52%

Rape seed biodiesel
Typical savings: 45%
Default value: 38%

RED Annex V.c: Methodology



Why harmonisation of biofuel GHG calculations?

- Input data
- 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	$gCO_{2\text{-eq}}/kg$
N-fertiliser		2827,0	8,68	9,6418	5880,6

Why harmonisation of biofuel GHG calculations?

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

Production of FAME from Rapeseed

Overview Results

Parameter
Nitrogen Fertilizer
P fertilizer
K fertilizer
CaO fertilizer (85%CaCO3+15%CaO,Ca(O
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%

Project BioGrace

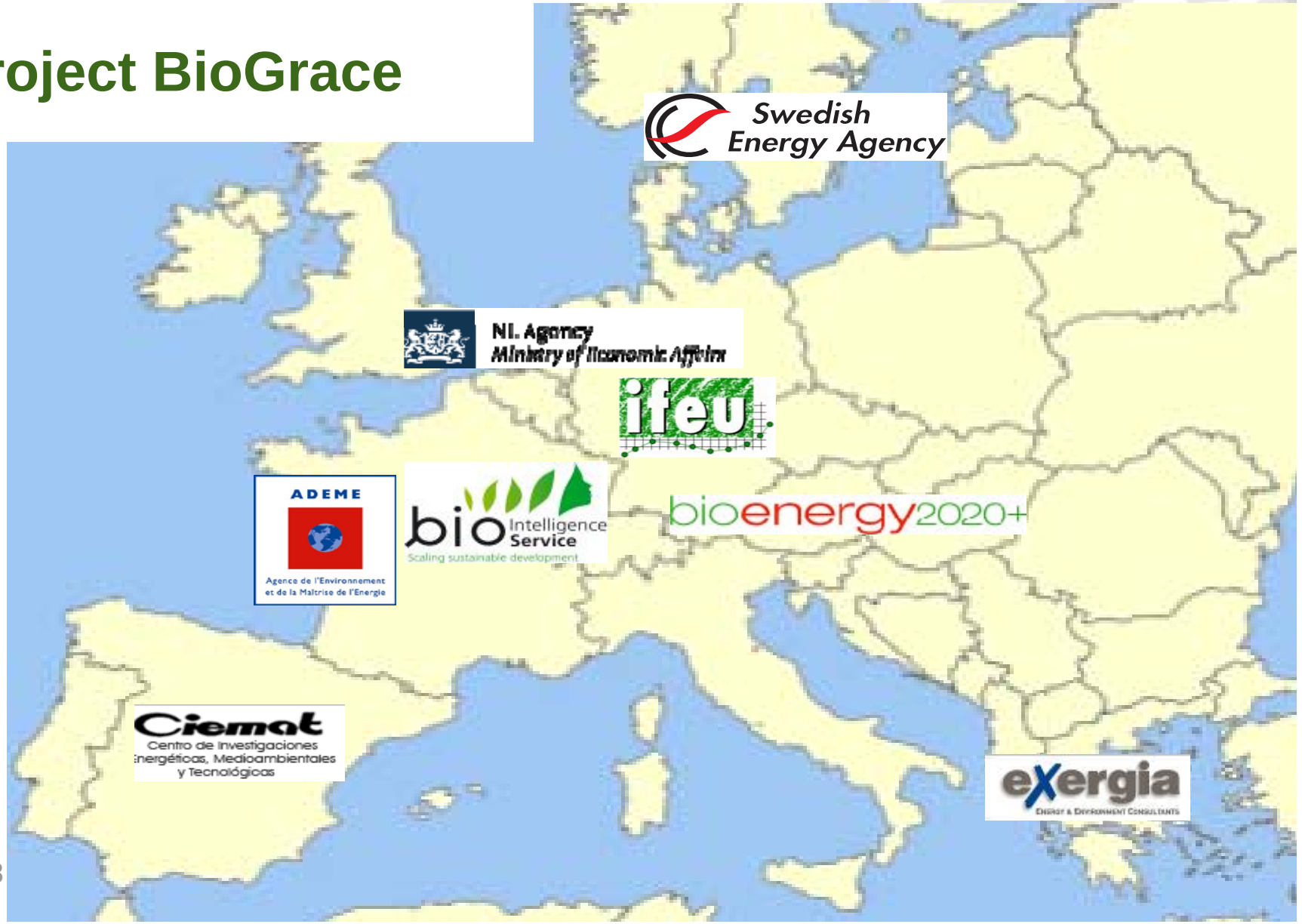
- **BIO**fuel **GR**eenhouse gas emissions: **A**lignment of **C**alculations in **E**urope
- Key objectives are
  1. Cause transparency
  2. Cause harmonisation
  3. Facilitate stakeholders
  4. Disseminate results
- Products
  1. One list of standard value
  2. Excel GHG calculation tool (-> voluntary certification scheme)
  3. Harmonised national GHG calculators

BIOGRACE

Harmonised Calculations of Biofuel Greenhouse Gas Emissions in Europe

Intelligent Energy Europe

Project BioGrace



BIOGRACE

Harmonised Calculations of Biofuel Greenhouse Gas Emissions in Europe

Intelligent Energy Europe

One list of

Version 3 - Public

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

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	9880										
Seeds- corn											
Seeds- rapeseed	412										
Seeds- soy bean											
Seeds- sugarbeet	218										
Seeds- sugarcane	1,										
Seeds- sunflower	41										
Seeds- wheat	151										
EFB compost (palm oil)	0,										
Fuels- gasses											
Natural gas (4000 km, Russian NG quality)											
Natural gas (4000 km, EU Mix quality)											
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

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

One list of standard values

- European Commission makes reference to list

Energy: Biofuels: Sustainability Criteria - European commission - Mozilla Firefox

Datei Bearbeiten Ansicht Chronik Lesezeichen Extras Hilfe

http://ec.europa.eu/energy/renewables/biofuels/sustainability_criteria_en.htm

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- European Technology Platforms (ETPs)
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RSS

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Biofuels: Sustainability Criteria

Commission sets up system for certifying sustainable biofuels

The Commission decided on 10 June 2010 to encourage industry, governments and NGOs to set up certification schemes for all types of biofuels, including those imported into the EU. It laid down what the schemes must do to be recognised by the Commission. This will help implement the EU's requirements that biofuels must deliver substantial reductions in greenhouse gas emissions and should not come from forests, wetlands and nature protection areas. The rules for certification schemes are part of a set of guidelines explaining how the Renewable Energy Directive, coming into effect in December 2010, should be implemented.

- Press release [IP/10/711, 10/06/2010]
- Memo [MEMO/10/247, 10/06/2010]

Related documents

Communications and Decision

Communication on the practical implementation of the EU biofuels and bioliquids sustainability scheme and on counting rules for biofuels [OJ C160, page 8]

- Standard values, derived from the datasets used to establish the default values
- Annotated example for the calculation of an actual greenhouse gas value [90 KB]
- Annotated example for the calculation of emissions from carbon stock changes due to land use change [3 MB]

Günther Oettinger Commissioner for Energy

Philip Lowe Director-General for Energy

Multimedia
Video portal

figures
.PDF
Publications

Agencies

- ACER
- EACI
- ESA

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How much do you know about energy?

EU Calendar

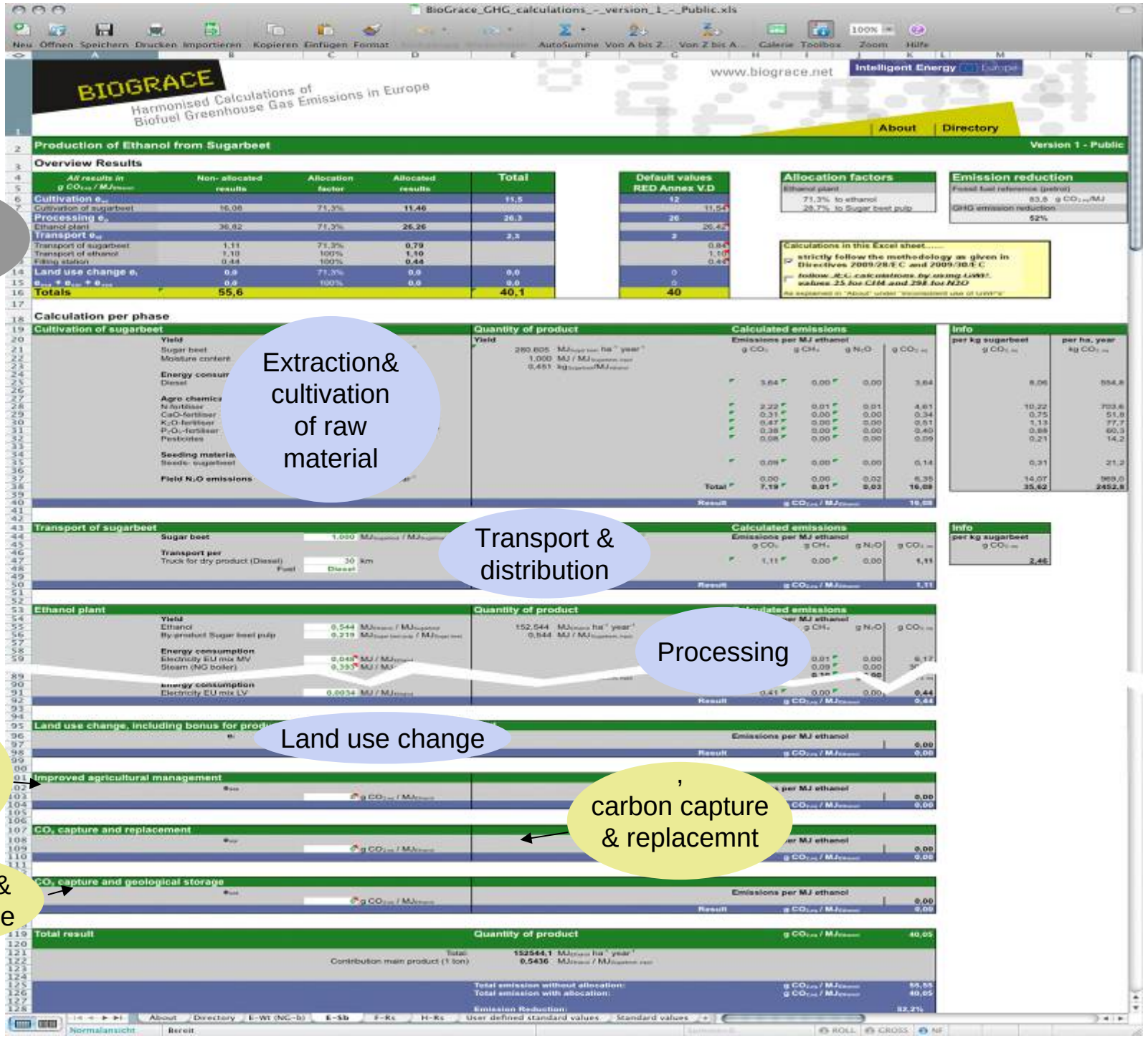
europe

http://ec.europa.eu/energy/publications/index_en.htm

One 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****.*

The Excel tool



Total results

Extraction& cultivation of raw material

Transport & distribution

Processing

Land use change

Soil carbon capture

Carbon capture & geological storage

, carbon capture & replacemnt

The cultivation box

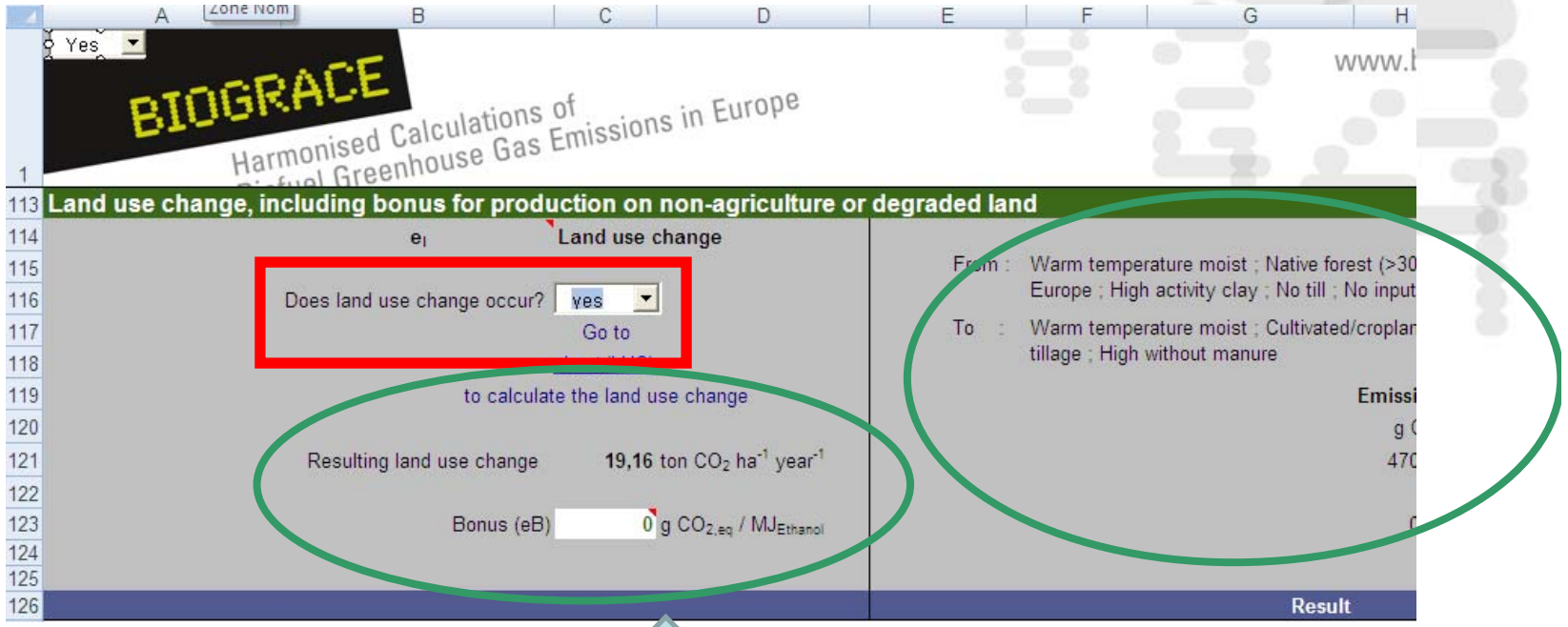
multiplying input values with "standard values"

Cultivation of rapeseed		Quantity of product	Calculated emissions			
		Yield	Emissions per MJ FAME			
			g CO_2	g CH_4	g N_2O	g $CO_{2,eq}$
Yield		73.975 $MJ_{Rapeseed}$ ha^{-1} $year^{-1}$				
Rapeseed	3.113 kg ha^{-1} $year^{-1}$	1,000 MJ / $MJ_{Rapeseed, input}$				
Moisture content	10,0%	0,073 $kg_{Rapeseed}/MJ_{FAME}$				
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 (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

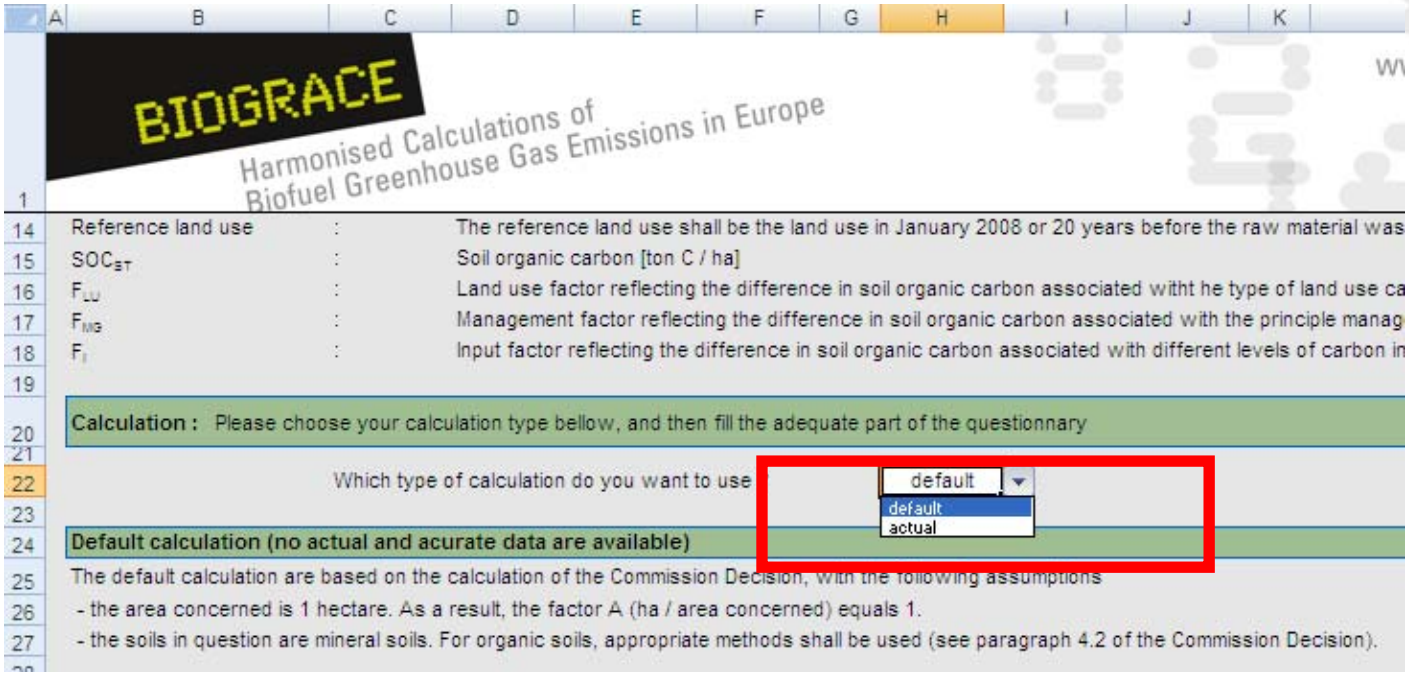
fill in actual data

The land use change box – step 1



Text will appear

Step 2 : Go to the LUC excel sheet and choose default calculation or actual calculation



Step 3a : default calculation according to the Commission‘s guidelines

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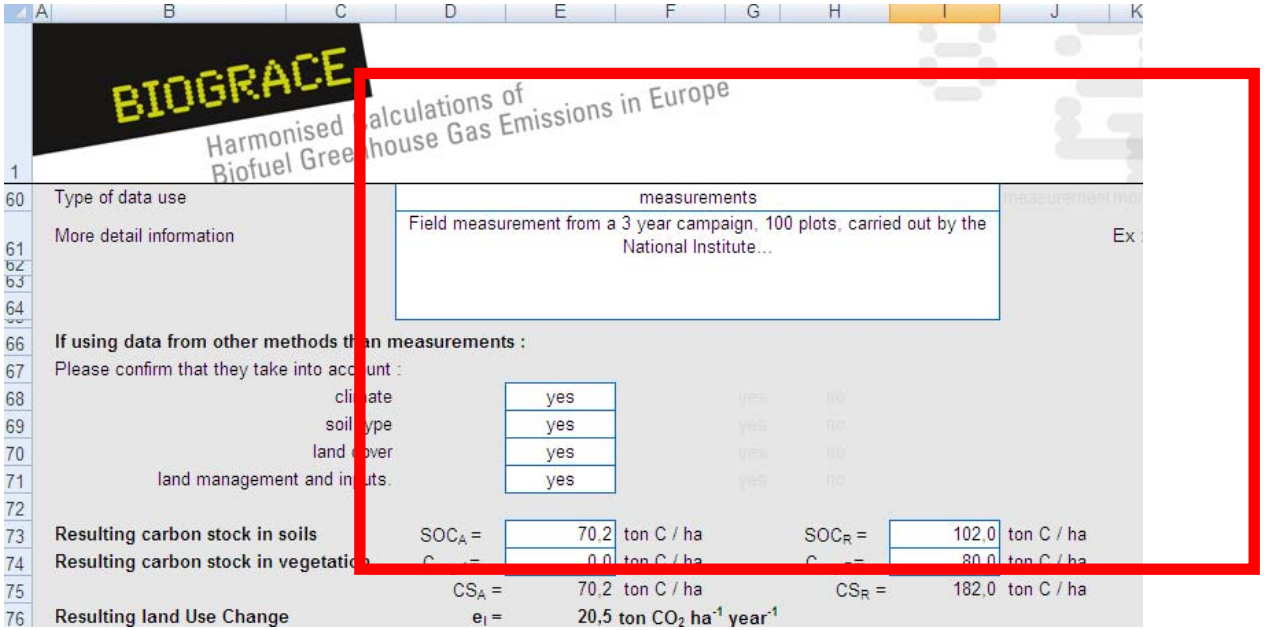
Commission Decision 2010/335/EU:

		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 valu
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

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

Step 3b (actual calculation) : fill in detailed information about your method



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} $year^{-1}$**						

Additional tools

- User manual
- rules for making calculations of actual value
- extra sheets for calculation of
  - direct land use change (based on Commission Decision)
  - N_2O emissions (based on IPCC Tier 1)
- list of recommended standard values

➢ **BioGrace will not:**

- add pathways to the Excel file with GHG calculations that are not listed in RED Annex V
- help stakeholders make actual calculations
- check actual calculations at the request of stakeholders

Recognition as a voluntary certification 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

Time schedule

- Submit BioGrace tool to EC for recognition in March or April
- Recognition period of 5 years probably

Thank you for your attention

INTELLIGENT ENERGY EUROPE

The aggregation box on top

from cultivation to filling station

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**		
Esterification	17,61	95,7%	**16,84**		17,88
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**