BIOGRACE II

Harmonised Greenhouse Gas Calculations
for Electricity, Heating and Cooling from Biomass

GHG calculations under RED and FQD

John Neeft
Agency NL
GHG calculation course for verifier trainers

Contents

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1. Background of GHG calculations

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Some comments before starting

- Course is interactive:
  - Questions and discussions most welcome !
  - Examples and exercises are important !
- Course focuses on verifying actual GHG calculations:
  - How to approve or disapprove with calculations?
  - Checking of data sources is not included
- Course is general biofuel GHG calculation course, but BioGrace tool to be used in many parts of the course as
  - It contains functions that are not included in some of the other tools (N_2O, LUC, track changes)
  - We expect it to be the most widely used tool

Relevant legislative documents

- Verification of actual GHG calculations can only be done if the verifier knows the requirements
  - from the European Commission
  - from the voluntary scheme under which the verification is to take place
- Please note that the content of the EC communications are not binding, the communications are not legislation but contain instructions on how things can be done

Relevant legislative documents

1. European legislation
   - Renewable energy directive (RED)
     - o Articles 17(2), 19 and Annex V

L 140/16 EN Official Journal of the European Union 5.6.2009

DIRECTIVES

DIRECTIVE 2009/28/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL

of 23 April 2009

on the promotion of the use of energy from renewable sources and amending and subsequently repealing Directives 2001/77/EC and 2003/30/EC

(Text with EEA relevance)

http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:32009L0028:EN:NOT

   - (FQD contains same requirements, default values and methodology)

Relevant legislative documents

2. European decisions and communications
   - Decision on carbon stocks
     which can be used to calculate land use change e_l and soil carbon accumulation via improved agricultural management e_{sca}

17.6.2010 | EN | Official Journal of the European Union | L 151/19

COMMISSION DECISION

of 10 June 2010

on guidelines for the calculation of land carbon stocks for the purpose of Annex V to Directive 2009/28/EC

(notified under document C(2010) 3751)

(2010/335/EU)

http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2010:151:0019:0041:EN:PDF

Relevant legislative documents

2. European decisions and communications (*continued*)
   - Communication on practical application
     - o Chapter 3 ‘Calculating the greenhouse gas impact’
     - o Annex I ‘Methods for calculating the greenhouse gas impact’
     - o Annex II ‘Methodology to calculate greenhouse gas impact: further elements’

C 160/8 EN Official Journal of the European Union 19.6.2010

Communication from the Commission on the practical implementation of the EU biofuels and bioliquids sustainability scheme and on counting rules for biofuels

(2010/C 160/02)

http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:C:2010:160:0008:0016:EN:PDF

Relevant legislative documents

2. European decisions and communications (*continued*)
   - Communication on voluntary schemes and default values
     - o Chapter 3 'default values'

19.6.2010 EN Official Journal of the European Union C 160/1

II

(Information)

INFORMATION FROM EUROPEAN UNION INSTITUTIONS, BODIES, OFFICES AND AGENCIES

EUROPEAN COMMISSION

Communication from the Commission on voluntary schemes and default values in the EU biofuels and bioliquids sustainability scheme

(2010/C 160/01)

http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:C:2010:160:0001:0007:EN:PDF

Relevant information on voluntary schemes

- All documentation on voluntary schemes can be accessed by:

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

- Relevant documentation is for instance:
  - ISCC: 2011 - GHG Emissions Calculation Methodology and GHG audit
  - RBSA: GHG emission methodology (full document to be obtained via scheme holder)
  - Greenergy: GHG Methodology
  - REDcert: 3_Requirements for GHG calculation_EU-KOM_EN_V3_15.02.2012

Relevant information on calculation tools

- Links to some of the available tools are:
  - BioGrace: Link to BioGrace tool
  - German tool: Link to German tool
  - Spanish tool: Link to Spanish tool
  - UK tool: Link to UK tool
  - Dutch tool: Link to Dutch tool

Points of attention for verifiers

- RED and communications say not much on using tools
- Our interpretation is that
  - Every tool (or empty Excel sheet or back of an envelope) may be used for actual calculations
  - Recognised voluntary schemes may not refer to calculation tools, unless these tools are recognised themselves
- BioGrace GHG calculation tool has been recognised
- Other tools are not (yet) send in for recognition by EC:
  - “National tools”: Germany, Spain, The Netherlands, UK
  - Tools developed / under development within recognised schemes: Bonsucro, RBSA, RSB

Points of attention for verifiers

- Currently:
  1) many pathways meet GHG criterion
  2) better GHG performance has no (financial) advantage
- Both will change in future:
  1) “Grandfathering clause” has been expired (1-4-2013) and GHG performance increases to 50% per 1-1-2017 and (for new installations) to 60% per 1-1-2018 (see RED 17.2)
  2) Importance of FQD will grow when 6% FQD target in 2020 comes nearer and/or if MS change legislation from a mandatory share of biofuels (in $MJ_{biofuels}$ per $MJ_{diesel+gasoline}$) to a mandatory GHG reduction
     - Germany has announced to do so per 1-1-2015

Basics of actual GHG calculations under the RED

- For making GHG calculations, you need:
  1. A methodology / rules
  2. Data from the process,
     such as yield of feedstock, input of fertilisers, efficiency of conversion plant, natural gas and electricity input etc. etc.
  3. Numbers/coefficients to convert data into GHG emissions
  4. Data/numbers for the reference process

- Important to understand:
  - LCA studies can be complicated and time-consuming
  - GHG calculations under RED are to some extend pragmatic, a number of assumptions have been made

Basics of actual GHG calculations under the RED

- 1. Methodology: RED Annex V.C (FQD Annex IV.C)

$$E = e_{ec} + e_{l} + e_{p} + e_{td} + e_{u} - e_{sca} - e_{ccs} - e_{ccr} - e_{ee}$$

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

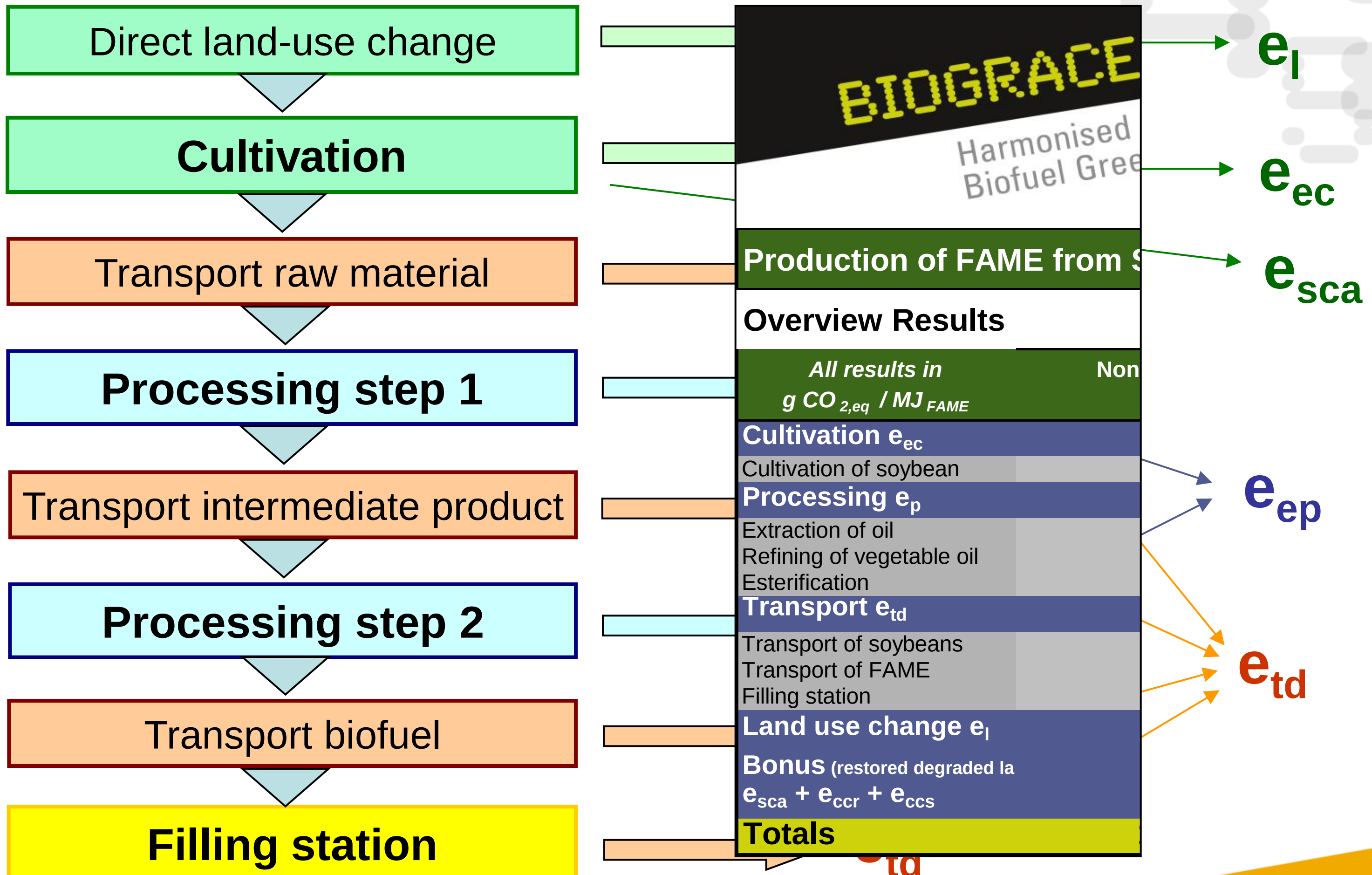
$ee_{ccs/ccr}$: very scarcely applied

e_{u}: zero for biofuels and bioliquids (V.C.13)

e_{l} and e_{sca} : following the decision 2010/335/EU

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

Basics of actual GHG calculations under the RED



Basics of actual GHG calculations under the RED

- RED methodology contains:
  - The functional unit: gram $CO_{2,eq}$ per $MJ_{biofuel}$
  - A decision on how to deal with co-products: allocation based on energy content
  - An approach how to calculate e_l and e_{sca} (in combination with "Decision on guidelines for the calculation of land carbon stocks")
  - A bonus for biofuels from degraded and heavily contaminated land (definition still to be given)
  - A rule on how to deal with excess electricity produced in a CHP within the boundaries of the LCS study
  - A rule that wastes and residues are considered to have zero emissions up to the process of their collection

Basics of actual GHG calculations under the RED

- RED methodology does not contain:
  - Values for emission coefficients
  - A precision of “defined region” for electricity from the grid in Annex V.C.11
  - A statement on which small emissions can be neglected
  - How to deal with heat as a co-product
- The communications contain some of these topics, however, communications are non-binding
- In some voluntary schemes (ISCC, BioGrace) these topics are included in the scheme documents

Basics of actual GHG calculations under the RED

- For making GHG calculations, you need:
  1. A methodology / rules
  2. Data from the process,
     such as yield of feedstock, input of fertilisers, efficiency of conversion plant, natural gas and electricity input etc. etc.
  3. Numbers/coefficients to convert data into GHG emissions
  4. Data/numbers for the reference process

- Important to understand:
  - LCA studies can be complicated and time-consuming
  - GHG calculations under RED are to some extend pragmatic, a number of assumptions have been made

Basics of actual GHG calculations under the RED

2. Data from the process

- In this course further called “input data”
- We have not been able to receive examples on how companies collect such data and send them to verifiers
- We assume that verifiers need no training on how to verify actual numbers delivered, such as
  - amount of natural gas and electricity consumed in a biofuel production plant over a given time span
  - Yield of a crop and input of fertilisers, pesticides etc over a given time span

Basics of actual GHG calculations under the RED

3. Numbers/coefficients to convert data into GHG emissions

- Are, for instance:
  - Emission coefficients (*eg* gram CO_2/CH_4/N_2O per MJ natural gas)
  - Lower heating values (MJ/kg)
  - Densities (kg/litre)
  - Transport efficiencies (MJ_{fuel} per ton per km)
  - Emissions of CH_4 and N_2O for boilers, CHP's (gram per MJ steam), trucks and ships (gram per ton per km)
- In GHG calculation tools these numbers/coefficients are assumed to be "fixed" or "standard"
- In this course further called "standard values"

Basics of actual GHG calculations under the RED

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

Cultivation of rapeseed			Calculated emissions			
Yield			**Emissions per MJ FAME**			
Rapeseed	3.113	kg ha^{-1} year^{-1}	g CO_2	g CH_4	g N_2O	g $CO_{2,eq}$
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[illegible]						
P_2O_5-[illegible]						
Pestic[illegible]						
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-eq}/kg
N-fertiliser	2827,0	8,68	9,6418	5880,6

Basics of actual GHG calculations under the RED

4. Data/numbers for the reference process

- Are defined in RED Annex V.C.19

19. For biofuels, for the purposes of the calculation referred to in point 4, the fossil fuel comparator E_F shall be the latest available actual average emissions from the fossil part of petrol and diesel consumed in the Community as reported under Directive 98/70/EC. If no such data are available, the value used shall be 83,8 gCO_{2eq}/MJ.

- Please note that:
  - Annex V will be updated by EC in the course of 2013
  - Reference values will change
    (as well as default values)

Verification of GHG calculations

When **verifying actual calculations**, a verifier should check:

1. Methodology and rules
2. Input data
3. Conversion numbers (standard values)
4. Data/numbers for the reference process
5. The calculation itself

BIOGRACE II

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2. Introduction on GHG calculation tools

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GHG calculation course for verifier trainers

Introduction

- LCA (Life cycle assessment) is used in many fields
- Long history in use for bio-energy assessments is old (see website of bio-energy Task 38 "Greenhouse Gas Balances of Biomass and Bioenergy Systems")
- Many tools exist for bio-energy, see (somewhat outdated) list of software tools on Task 38 website
- Smaller amount of tools for biofuels:
  - Some tools in North-America (GREET, GHGenius)
  - A number of tools in Europe:
    - "National tools" in Germany, Spain, The Netherlands and UK
    - Tools developed in voluntary schemes: BioGrace, Bonsucro, RBSA, RSB
  - Possibly some others that we do not know of……

Introduction

- This presentation (plus next one and presentation in block 2) is on 'national tools' and on BioGrace and RSB tools:
  - BioGrace: Link to BioGrace tool
  - RSB: Link to RSB tool
  - German tool: Link to German tool
  - Spanish tool: Link to Spanish tool
  - UK tool: Link to UK tool
- Dutch tool (Link to Dutch tool) will not be presented as tool will not be further updated
- Bonsucro and RBSA tools are not public (yet)

Reason for existence of several tools

Why are there so many tools?

- There are at least three reasons:
  1. Some tools already existed before BioGrace was made with the aim to harmonise calculations (come to same results): NL, UK. The creation of other tools Excel tool had been started on approximately the same moment in time: ES, GE, RSB
  2. We could not use one of the existing tools for building the BioGrace tool:
     - The owners of the other tools would not have agreed
     - We wanted a transparent excel-based tool, the other tools were not Excel based and/or not fully transparent
  3. The other tools serve different uses (next sheet)

Reason for existence of several tools

- Different uses of tools:
  1. Links to national biofuel regulation and/or reporting system (German tool, UK tool)
  2. Allows to use detailed agricultural data (NUTS-4) in calculations (Spanish tool)
  3. Allows calculations under different methodologies (RSB tool, both RSB methodology and RED methodology)
  4. To become EC voluntary scheme (BioGrace, others might follow)

Do these tools give the same results?

- BioGrace aimed to harmonise the national tools
  - This was the aim of the IEE project BioGrace (June 2010-June 2012) which is different from the GHG calculation tool BioGrace
  - This harmonisation has been realised by (1) using the same standard values and (2) updating calculations (see next slide)
- Bonsucro, RBSA and RSB tools have not been part of this harmonisation approach
  - BioGrace and RSB tools give different results:
    - **Biofuel greenhouse gas calculations under the European Renewable Energy Directive – A comparison of the BioGrace tool vs. the tool of the Roundtable on Sustainable Biofuels** *Applied Energy*, ***In Press, Corrected Proof***, *Available online 12 May 2012*
      Anna M. Hennecke, Mireille Faist, Jürgen Reinhardt, Victoria Junquera, John Neeft, Horst Fehrenbach

Do these tools give the same results?

Results from harmonisation (full table available at www.biograce.net):

	Table A RED Annex V/FQD Annex IV	Diferences with BIOGRACE tool			
Biofuel production pathways	Default value	The Netherlands ANL	Germany IFEU	Spain CIEMAT	UK
Ethanol wheat lignite	70	0,0	0,0	-0,1	0,0
Ethanol wheat (proces fuel not specified)	70	0,0	0,0	-0,1	0,1
Ethanol wheat (natural gas - steam boiler)	55	0,0	0,0	0,0	0,0
Ethanol wheat (natural gas - CHP)	44	0,0	0,2	0,0	0,0
Ethanol wheat (straw)	26	0,0	0,0	0,0	-0,6
Ethanol corn	43	0,0	0,2	0,0	0,0
Ethanol sugarbeet	40	0,0	0,0	0,6	-0,2
Ethanol from sugarcane	24	0,0	0,0	-0,2	-0,1
Biodiesel rape seed	52	0,0	-0,5	0,0	-0,1
Biodiesel palm oil	68	0,0	0,3	-0,1	-0,2
Biodiesel palm oil (methane capture)	37	0,1	0,4	-0,2	-0,1
Biodiesel soy	58	0,1	0,0	0,1	-0,2
Biodiesel sunflower	41	0,0	-0,4	0,0	-0,1
Biodiesel UCO	14	0,0		0,0	
PVO rape seed	36	0,0	0,0	0,1	-0,1
HVO rape seed	44	0,0		0,1	-0,1
HVO palm oil	62	0,0		0,0	-0,1
HVO palm oil (methane capture)	29	0,0		0,0	-0,1
HVO sunflower	32	0,0		0,0	0,0
Biogas - dry manure	15	0,0		0,0	0,0
Biogas - wet manure	16	0,0		-0,2	0,0
Biogas - Municipal organic waste.	23	0,0		0,0	-0,1

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GHG calculations under RED and FQD

3. Tools for GHG calculation

- Spanish & UK calculator & BioGrace

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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

Contents

Spanish tool - general information

Background

- Aim: to provide stakeholders (especially farmers and small biofuel companies in Spain) with a tool to calculate the GHG emissions required by the RED

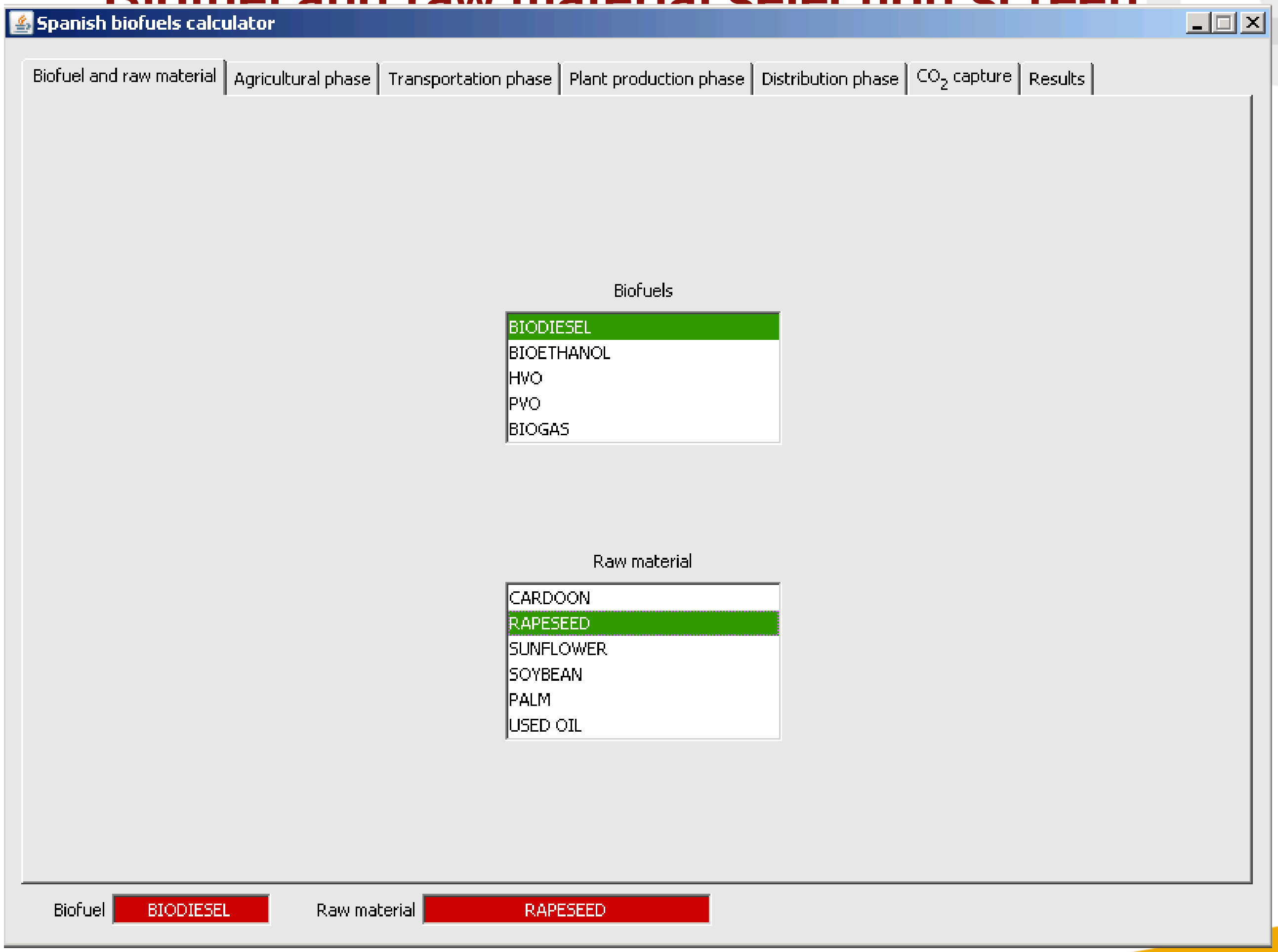
The Spanish GHG calculator

- 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 GHG tool

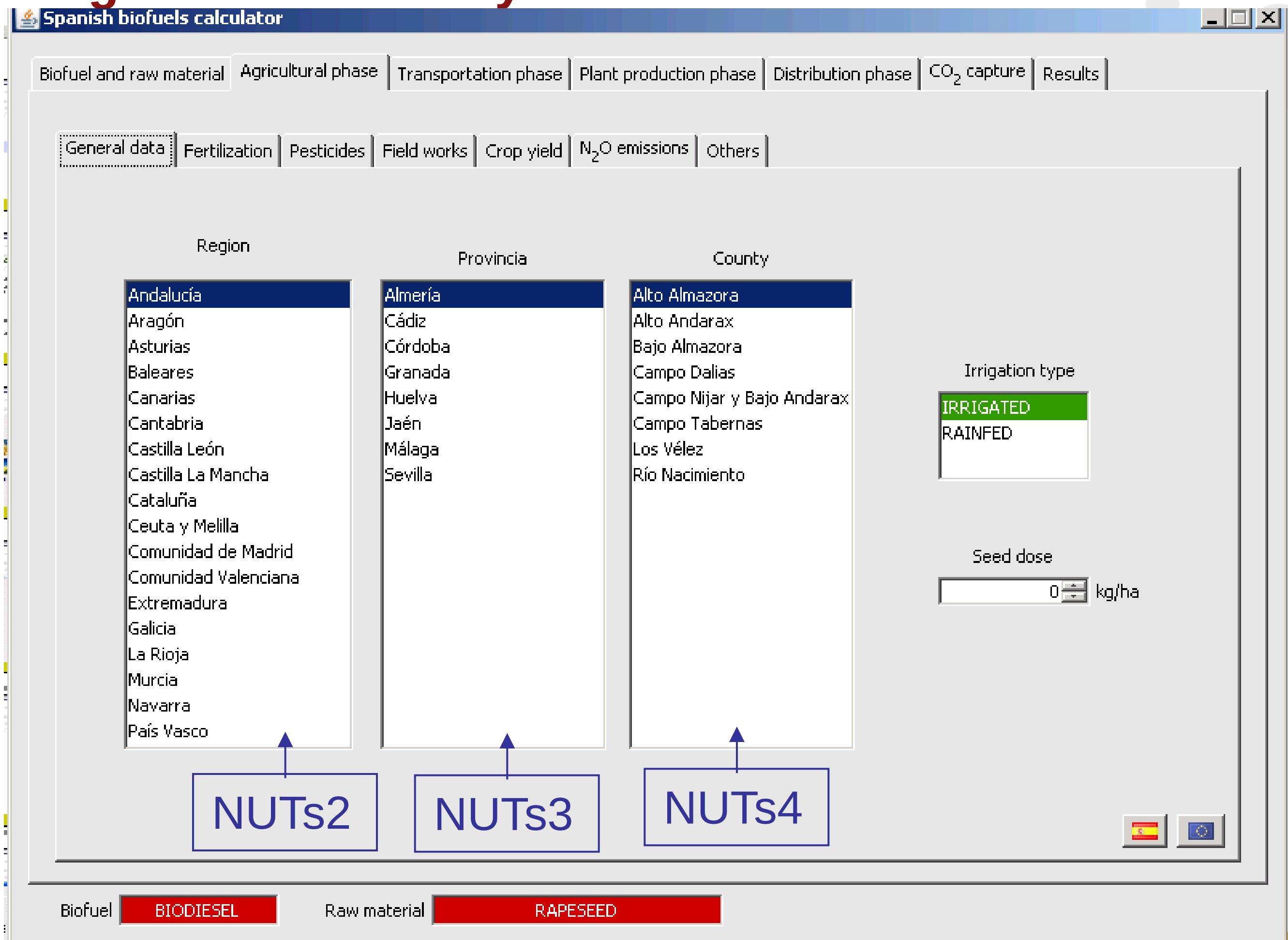
Spanish GHG tool

Biofuel and raw material selection screen



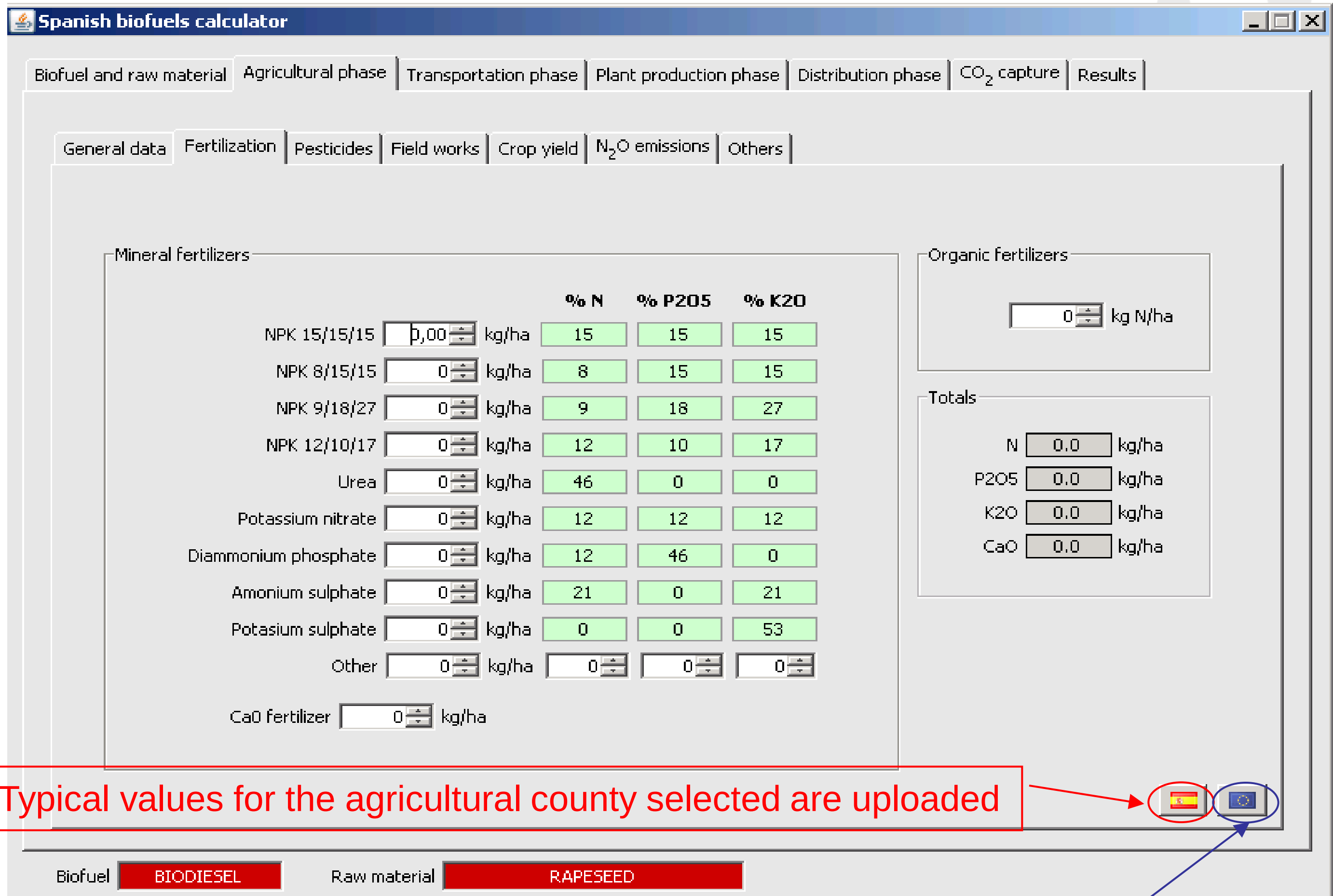
Spanish GHG tool

Agricultural county selection screen



Spanish GHG tool

Fertilization data input screen

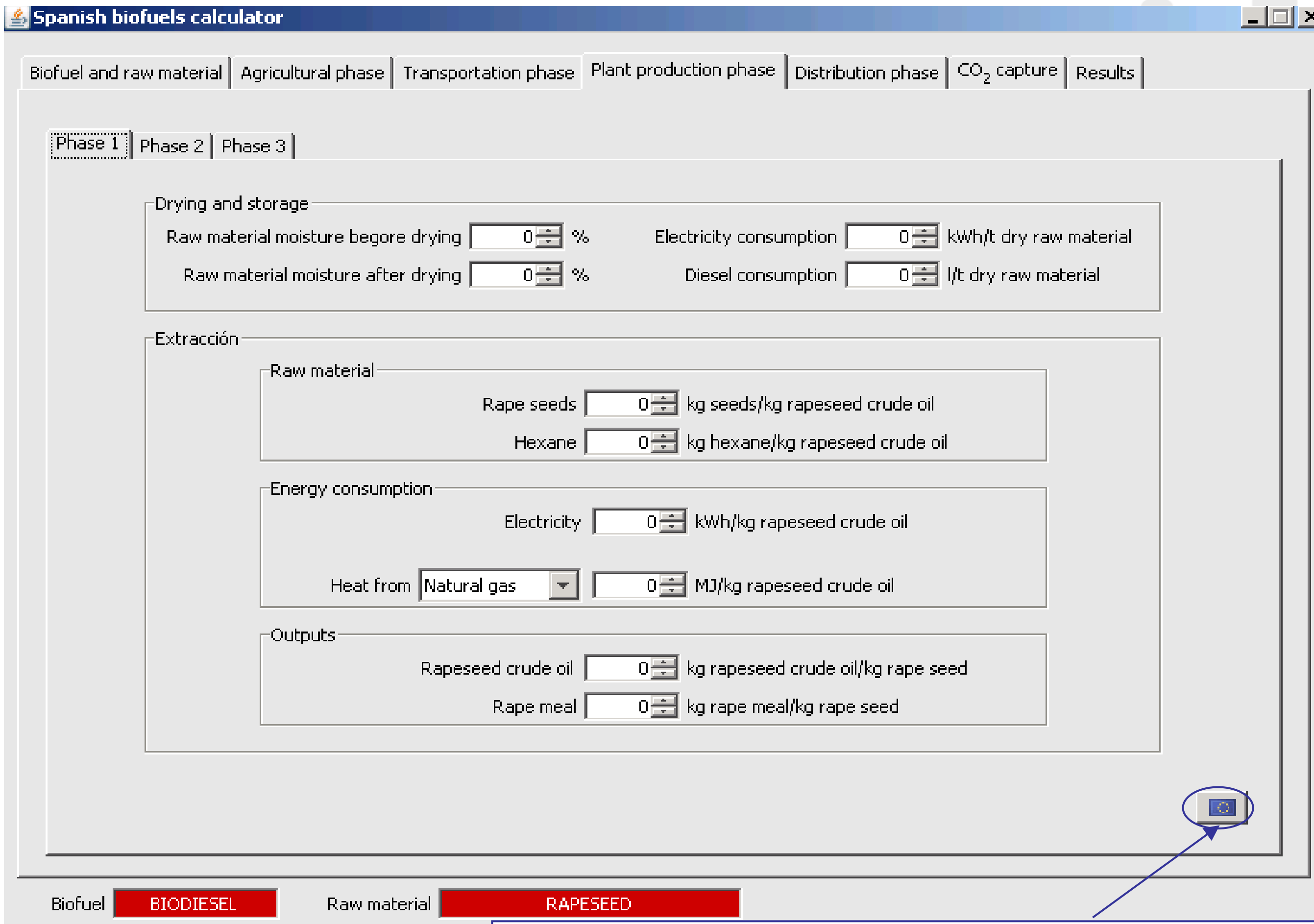


Typical values for the agricultural county selected are uploaded

Values to reproduce the default values of the RED are uploaded

Spanish GHG tool

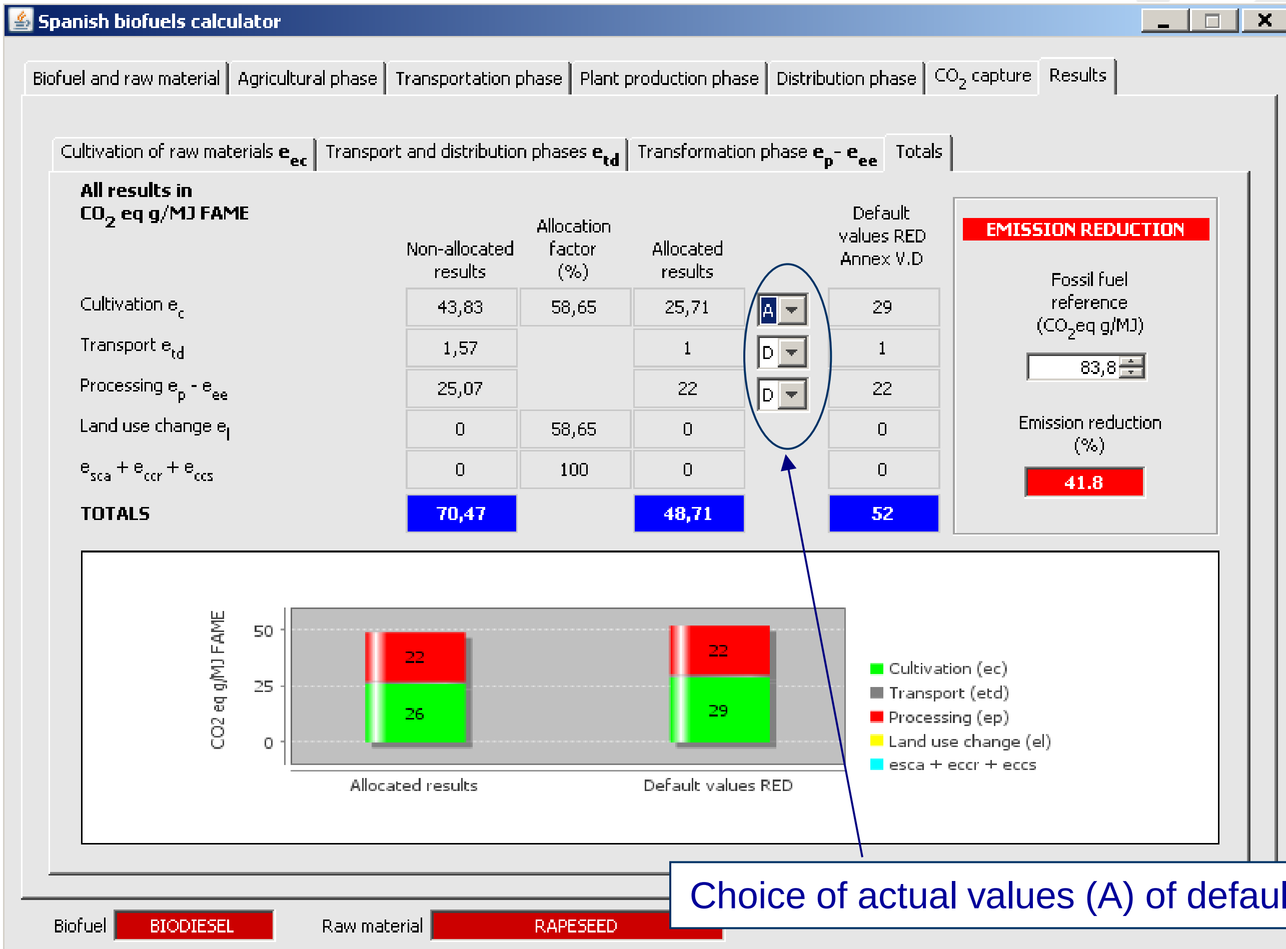
Transformation data input screen



Values to reproduce the default values of the RED are uploaded

Spanish GHG tool

Results screen



Choice of actual values (A) of default values (D)

Spanish tool - Summary

Contents

- NUTS-2 results of Spain can be uploaded:
  - Contains data on agricultural inputs and yields for 5 crops (wheat, barley, sunflower, rapeseed and sweet sorghum) used to produce biofuels in Spain at the level of agrarian county (NUTs4)
- For transport of raw materials: from the selected region to the nearest processing plant in Spain.
- For processing: tool contains only RED default values
- Standard values from BioGrace, does not allow to change or use own standard values
- Does not allow to change or add pathways
- Functional units differ from BioGrace

Status: Working on including

- Data of sugarbeet and corn
- Several inputs (phosphoric acid, sodium hydroxide, citric acid, sodium methylate, etc) commonly used in biofuels Spanish industry
- Other fuels (diesel, fuel-oil and biomass) in the drying phase and in the distribution phase the transportation by pipeline.
- Tool online via www.idea.es including a (Spanish) user manual
- Tool has not been submitted for recognition
- After the updates from EU (with new chains) the tool is prospected to be updated

Contents

UK tool - general information

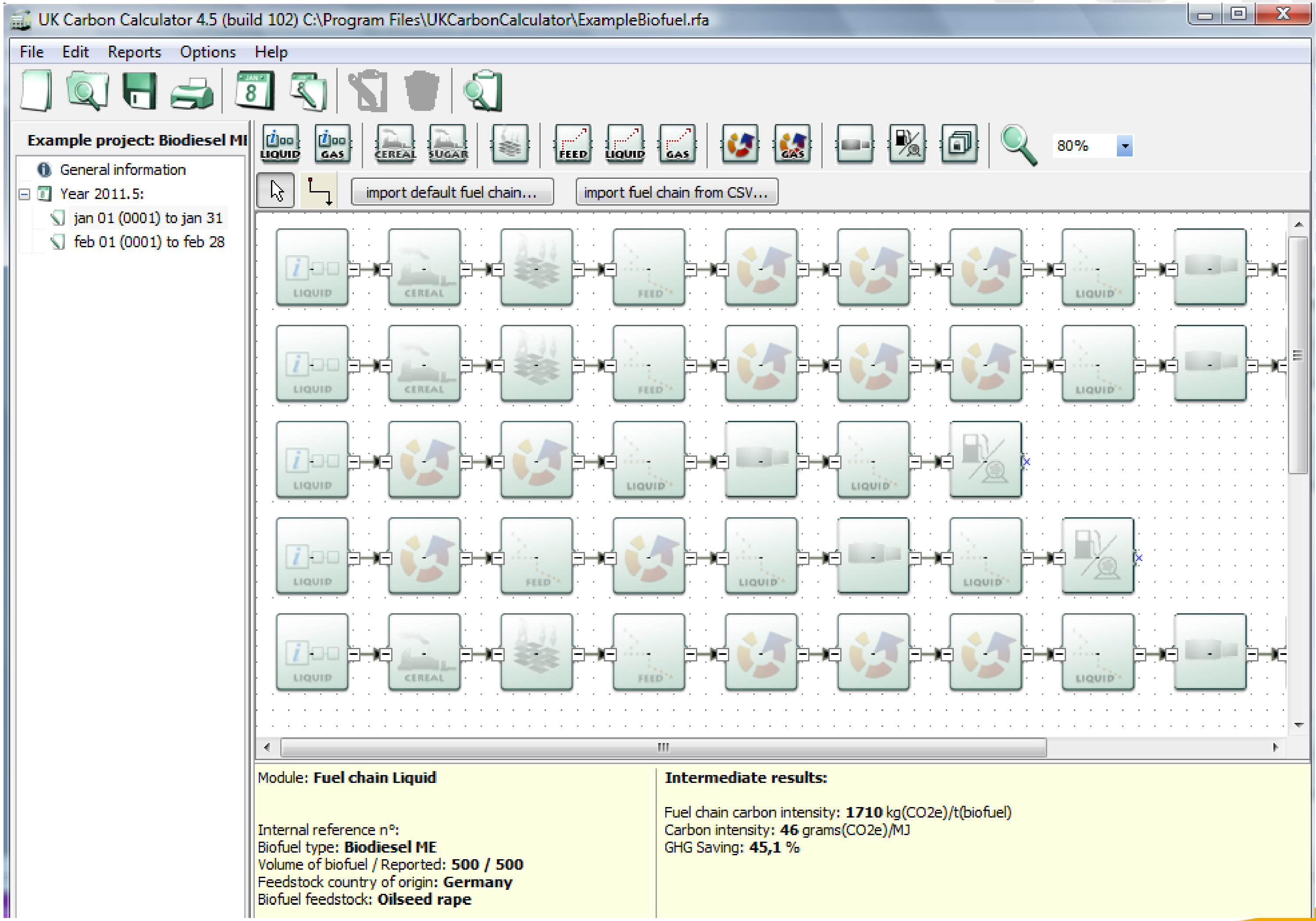
Background

- UK GHG calculator was developed under RTFO reporting scheme
- Calculator existing since 2008, regularly updated
- Version 4.5 is for reporting year 2011/2012 (and further)
- 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 been made “RED-proof”
- strongly linked to RTFO reporting scheme
- provides the “default chains” as compared to BioGrace

UK GHG tool


UK Carbon Calculator 4.5 (build 102) C:\Program Files\UKCarbonCalculator\ExampleBiofuel.rfa
File Edit Reports Options Help
Example project: Biodiesel MI
General information
Year 2011.5:
jan 01 (0001) to jan 31
feb 01 (0001) to feb 28
import default fuel chain...
import fuel chain from CSV...
80%
Module: Fuel chain Liquid
Internal reference n°:
Biofuel type: Biodiesel ME
Volume of biofuel / Reported: 500 / 500
Feedstock country of origin: Germany
Biofuel feedstock: Oilseed rape
Intermediate results:
Fuel chain carbon intensity: 1710 kg(CO2e)/t(biofuel)
Carbon intensity: 46 grams(CO2e)/MJ
GHG Saving: 45,1 %

UK GHG tool- block: fuel chain liquid

Basic data

Module description:

Details and links to verification evidence:

General information

Internal reference n° (optional)

Administrative consignment n°

Fuel type produced: Biodiesel ME

Quantity of fuel: 500

Final reported quantity of fuel: 500

Feedstock: Oilseed rape

Production process: -

Fuel chain default value: 52,0 grams(CO2e)/MJ

Country of origin information

Country: Germany

NUTS 2 region: DE13 - Freiburg

Compliant NUTS2 Region: No / Yes / Unknown

Sustainability information

Voluntary scheme 1: International Sustainability & C

Voluntary scheme 2: -

Voluntary scheme 3: -

Note: you should only enter a scheme above if you have used a version approved by the commission.
To check, see the DfT RTFO Website

Land use on 01 Jan 2008: Cropland - non protected

Other information

Plant was in operation on 23 Jan 2008: no

Soil Carbon Accumulation: no

Type of GHG data: Actual data for cultivation

Intermediate results:
Fuel chain carbon intensity: **1930** kg(CO2e)/t(biofuel)
Carbon intensity: **51,9** grams(CO2e)/MJ
GHG Saving: **38,1** %

GHG
Biodiversity
C-stock
RED compliant (indicative)

UK GHG tool- module: crop production

Emissions from cultivation

(•) Use NUTS2 cultivation emissions

NUTS2 Crop yield: 4,20 Tonnes(feedstock)/ha

NUTS2 cultivation impact: 529,2 kg(CO2e)/Tonnes(feedstock) subtotal **529,2**

( ) Use regional average values

Regional average Crop yield: 0,00 Tonnes(feedstock)/ha

Regional average cultivation impact: 0,0 kg(CO2e)/Tonnes(feedstock)

( ) Use the RED cultivation GHG emission calculations

Rate of nitrous oxide emissions per hectare: 924,7 kg(CO2e)/ha

subtotal 296,991

Farming inputs

Fertilisers

Type	Description	Application...	Unit	Emissions f...	Unit	Nitrogen c...	Unit	Total emissi...
Unspecified N ...		137,4292	kg(nutrien...	5,9172313	kg(CO2e)/...	1	kg(N)/kg(...	261
Unspecified P ...		33,6731	kg(nutrien...	1,0135085	kg(CO2e)/...	0	kg(N)/kg(...	11

UK GHG tool- module: crop production

Farming inputs

Fertilisers

Type	Description	Application...	Unit	Emissions f...	Unit	Nitrogen c...	Unit	Total emissi...
Unspecified N ...		137,4292	kg(nutrien...	5,9172313	kg(CO2e)/...	1	kg(N)/kg(...	261
Unspecified P ...		33,6731	kg(nutrien...	1,0135085	kg(CO2e)/...	0	kg(N)/kg(...	11
Unspecified K ...		49,4567	kg(nutrien...	0,5792488	kg(CO2e)/...	0	kg(N)/kg(...	9,2
Lime fertiliser (...		19	kg(nutrien...	0,1299669	kg(CO2e)/...	0	kg(N)/kg(...	0,79

subtotal **282,14**

Pesticide application rates: 1,23 kg(active ingredient)/ha

Pesticide emissions factor: 11,0 kg(CO2e)/kg(active ingredient)

subtotal **4,356**

Other inputs

Type	Description	Use	Unit	Emissions factor	Unit	Total emissions
Oilseed rape s...		6	kg(product)/ha	0,733733	kg(CO2e)/kg(pr...	1,41

subtotal **1,41**

On-farm fuel use

Type	Description	Use	Unit	Emissions factor	Unit	Total emissions
Diesel		82,5	l(fuel)/ha	0,0876388888888889	kg(CO2e)/MJ	83,4

Intermediate results:
Total for this module: **668** kg(CO2e)/t(crop)
Contribution of this module to fuel chain: **1060** kg(CO2e)/t(biofuel)
Percentage contribution to chain: **55** %
Total emissions up to this module: **668** kg(CO2e)/t(output)

Reset Print Close

UK tool - Summary

Contents

- Tool can produce supplier monthly and annual C&S reports
- Easy to modify pathways or build new ones
- Tool is for UK reporting under RTFO and contains more information than GHG (the amounts of biofuel, verification schemes, biodiversity & RED compliant)

Status

- Tool on-line via www.renewablefuelsagency.gov.uk including a user manual
- All chains give same result as compared to RED defaults
- Only defaults RED from year 4.5 onwards (other chains are still available if an earlier year is selected)
- Tool has not been submitted for recognition

UK tool - Summary

- Standard values used from BioGrace, and does allow to change or use own standard values (emission factors)
- There a special field for details for verification evidence in each block
- Actual data stored in a module is shown in bold text
- Nuts-2 results can be uploaded
- Difference in rule using Nuts-2 results. In BioGrace only the Nuts-2 input values may used, in UK the Nuts-2 results may be used.
- Functional units differ from BioGrace

Contents

Contents BioGrace

1. Navigate through tool
2. Calculation sheets per chain
3. Track changes
4. Inconsistent use of global warming potentials
5. Standard values
6. Define own standard values
7. List of additional standard values
8. Calculation of Direct Land use change
9. Calculation of Improved agricultural management Esca
10. Calculation of N_2O emissions IPCC tier 1
11. User manual + calculation rules

Discussed in Block 4

Directory / Navigation tool


BIOGRACE
Harmonised Calculations of Biofuel Greenhouse Gas Emissions in Europe
www.biograce.net
Intelligent Energy Europe
About
Directory
Directory of pathways
Version 4b - Public

1 Ethanol from sugar beet
2 Ethanol from wheat (process fuel not specified)
3 Ethanol from wheat (lignite CHP)
4 Ethanol from wheat (natural gas steam boiler)
5 Ethanol from wheat (natural gas CHP)
6 Ethanol from wheat (straw CHP)
7 Ethanol from corn (community produced) (natural gas CHP)
8 Ethanol from sugarcane
9 FAME from rape seed
10 FAME from sunflower
11 FAME from soybean
12 FAME from palm oil (process not specified)
13 FAME from palm oil (methane capture at oil mill)
14 FAME from waste vegetable or animal oil
15 HVO from rape seed
16 HVO from sunflower
17 HVO from palm oil (process not specified)
18 HVO from palm oil (methane capture at oil mill)
19 PVO from rape seed
20 CNG from biogas from municipal organic waste
21 CNG from biogas from wet manure
22 CNG from biogas from dry manure

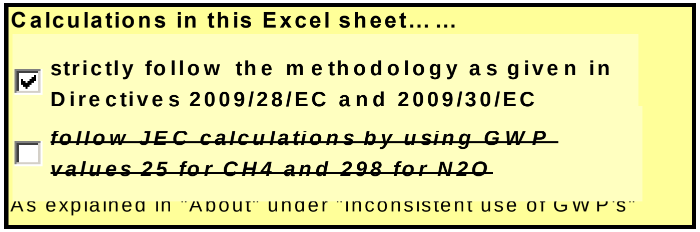
Calculation of direct land use change (LUC)
Calculation of Improved Agricultural Management
Calculation of N_2O field emissions according to IPCC Tier 1

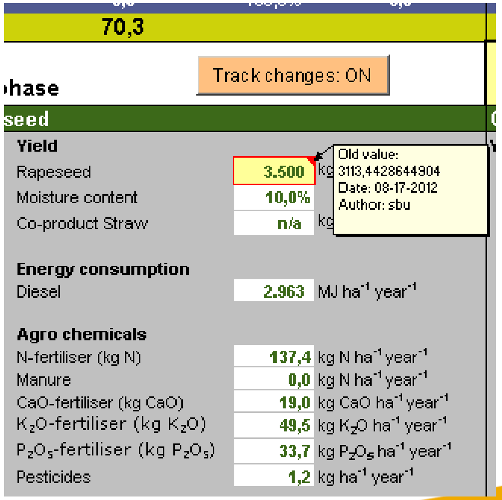
About
Directory / LUC / Esca / N2O emissions IPCC / E-Sb / E-Wt (not.spec.) / E-Wt (Lign-chp) / E-Wt (NG-b) / E-Wt (NG-chp) / E-Wt (Str-chp) / E-Co

- Includes all pathways for which RED-default values exist
- One calculation sheet per pathway
- Easy directing to other sheets

When actual calculations are done:

- The Biograce rules must be followed
- The Global Warming Potentials as given in 2009/28/EC & 2009/30/EC: 23 for CH_4 and 296 for N_2O, plus rounded LHV values
- Track changes must be switched on:
  - Highlights all changes
  - Shows editor's name and old values in the comment field





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	Actual/ Default	Default values RED Annex V.D
Cultivation e_{ec}				28,9	A	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	A	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	A	1
Transport of rapeseed	0,30	58,6%	**0,17**			0,17
Transport of FAME	0,82	100,0%	**0,82**			0,82
Filling station	0,44	100,0%	**0,44**			0,44
Land use change e_l	0,0	58,6%	0,0	0,0		0
Bonus (restored degra	0,0	100,0%	0,0	0,0		0
$e_{sca} + e_{ccr} + e_{ccs}$	0,0	100,0%	0,0	0,0		0
Totals	**76,1**			**52,0**		**52**

When using this GHG calculation tool, **the BioGrac**
The rules are included in the zip file in which you do

Calculation per phase

Track changes: OFF

Indication of actual (A) and default values (D)

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	Actual/ Default	Default values RED Annex V (D)
Cultivation e_{ec}				**29,0**	**D**	
Cultivation of rapeseed	43,01	58,6%	**25,20**			[illegible]
Rapeseed drying	0,72	58,6%	**0,42**			[illegible]
Processing e_p				**21,6**	**A**	[illegible]
Extraction of oil	6,50	58,6%	**3,81**			3,82
Refining of vegetable oil	1,06	95,7%	**1,01**			17,88
Esterification	17,51	95,7%	**16,75**			
Transport e_{td}				**1,4**	**A**	**1**
Transport of rapeseed	0,30	58,6%	**0,17**			0,17
Transport of FAME	0,82	100,0%	**0,82**			0,82
Filling station	0,44	100,0%	**0,44**			0,44
Land use change e_l	**0,0**	58,6%	**0,0**	**0,0**		0
Bonus (restored degra	**0,0**	100,0%	**0,0**	**0,0**		0
$e_{sca} + e_{ccr} + e_{ccs}$	**0,0**	100,0%	**0,0**	**0,0**		0
Totals	**70,3**			**52,0**		**52**

Old value: A
Date: 08-17-2012
Author: sbu

When using this GHG calculation tool, **the BioGrace c**
The rules are included in the zip file in which you dowr

Track changes: ON

Calculation per phase

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}

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}						
<u>NG Boiler</u>					<u>Emissions from NG boiler</u>			
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

Allocation

- Allocation of emissions of product and co-product is done by energy content (LHV)

Allocation over main- and co-product			Total emission before allocation:			g $CO_{2,eq}$ / MJ_{FAME}	56,17
			Emissions up to and including this process step:			56,17 g $CO_{2,eq}$ / MJ_{FAME}	
Main product:	Rapeseed oil	Energy content (based on 1 MJ)	1,0000	MJ		34,40 g $CO_{2,eq}$ / MJ_{FAME}	
Co-product:	Rapeseed cake	Energy content co-product	0,6326	MJ		21,77 g $CO_{2,eq}$ / MJ_{FAME}	
		Total:	1,6326	MJ			
			Total emission after allocation:			g $CO_{2,eq}$ / MJ_{FAME}	34,40

Info
per kg oil
g $CO_{2,eq}$
1181,37

- Summerized in the overview on top

Allocation factors
Extraction of oil
61,3% to Rapeseed oil
38,7% to Rapeseed cake
Esterification
95,7% to FAME
4,3% to Refined glycerol

Introduction standard values

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

List of standard values

Version 4 - Public

1	2	3	4	5	6
STANDARD VALUES parameter:	**GWP**	**GHG emission c…**			
unit:	$gCO_{2,eq}$/ g	gCO_2/kg	gCH_4/kg	gN_2O/kg	$gCO_{2\text{-}eq}$/kg
Global Warming Potentials (GWP's)					
CO_2	1				
CH_4	23				
N_2O	296				
Agro inputs					
N-fertiliser (kg N)		2827,0	8,68	9,6418	5880,6
P_2O_5-fertiliser (kg P_2O_5)		964,9	1,33	0,0515	1010,7
K_2O-fertiliser (kg K_2O)		536,3	1,57	0,0123	576,1
CaO-fertiliser (kg CaO)		119,1	0,22	0,0183	129,5
Pesticides		9886,5	25,53	1,6814	10971,3
Seeds- corn		0,0	0,00	0,0000	0,0
Seeds- rapeseed		412,1	0,91	1,0028	729,9
Seeds- soy bean		0,0	0,00	0,0000	0,0
Seeds- sugarbeet		2187,7	4,60	4,2120	3540,3
Seeds- sugarcane		1,6	0,00	0,0000	1,6
Seeds- sunflower		412,1	0,91	1,0028	729,9
Seeds- wheat		151,1	0,28	0,4003	275,9
Residues (feedstock or input)					
EFB compost (palm oil)		0,0	0,00	0,0000	0,0
Filter mud cake		0,0	0,00	0,0000	0,0
Manure		0,0	0,00	0,0000	0,0
Vinasse		0,0	0,00	0,0000	0,0

User defined standard values

Version 4b - Public						
1	2	3	4	5	6	
User Defined Standard Values parameter:	Comments				GHG emission coe	
unit:		gCO_2/kg	gCH_4/kg	gN_2O/kg	gCO_{2-eq}/kg	gCC
User defined standard values						
Example 1 (diesel from standard values)					0	87,
Example 2 (methanol from standard values)					0	92,
Example 3 (N-fertiliser from standard values)		2827,0	8,68	9,6418	5880,5901	
					0	
					0	
Ammonium Nitrate		2900,0	0,00	0,0000	2900	
Urea		1707,0	0,00	0,0000	1707	
Compound		5376,0	0,00	0,0000	5376	
					0	
					0	
					0	
					0	
					0	

Fill in user defined standard values in list

User defined standard values

Fill the names (2) and amounts (3)
and copy conversion formulas (4) when rows (1) are added

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 rapeseed			**Quantity of product**	**Calculated emissions**				**Info**	
	Yield			**Yield**	**Emissions per MJ FAME**				**per kg rapeseed**	**per ha, year**
	Rapeseed	3.060	kg ha^{-1} $year^{-1}$	80.784 $MJ_{Rapeseed}$ ha^{-1} $year^{-1}$	g CO_2	g CH_4	g N_2O	g $CO_{2,eq}$	g $CO_{2,eq}$	kg $CO_{2,eq}$
	Moisture content	0,0%		1,000 MJ / $MJ_{Rapeseed,input}$						
	Co-product Straw	n/a	kg ha^{-1} $year^{-1}$	0,065 $kg_{Rapeseed}$/MJ_{FAME}						
	Energy consumption									
	Diesel	4.447	MJ ha^{-1} $year^{-1}$		8,34	0,00	0,00	8,34	127,36	389,7
	Agro chemicals	3								
	Ammonium Nitrate	143,0	kg N ha^{-1} $year^{-1}$		8,87	0,00	0,00	8,87	135,52	414,7
1	Urea 2	40,0		4	1,46	0,00	0,00	1,46	22,31	68,3
	Compound	9,0			1,04	0,00	0,00	1,04	15,81	48,4
	Manure	0,0	kg N ha^{-1} $year^{-1}$		0,00	0,00	0,00	0,00	0,00	0,0
	CaO-fertiliser (kg CaO)	0,0	kg CaO ha^{-1} $year^{-1}$		0,00	0,00	0,00	0,00	0,00	0,0
	K_2O-fertiliser (kg K_2O)	34,0	kg K_2O ha^{-1} $year^{-1}$		0,39	0,00	0,00	0,42	6,40	19,6
	P_2O_5-fertiliser (kg P_2O_5)	29,0	kg P_2O_5 ha^{-1} $year^{-1}$		0,60	0,00	0,00	0,63	9,58	29,3
	Pesticides	2,6	kg ha^{-1} $year^{-1}$		0,55	0,00	0,00	0,61	9,32	28,5

List of additional standard values

- When a standard value is not on the BioGrace list of standard values, it is recommended to take a number from this list of additional standard values - if available on this list - and to include the reference that is given in this list as reliable information on how the value was determined.

Contains data for selections of

- mineral fertilizer types and other agro inputs
- conversion inputs (process chemicals)
- national electricity grids
- solid and gaseous biomass sources for energy
- transport (pipeline)

BioGrace tool -summery

Contents

- o Rather easy to modify or build new pathways
- o Own defined standard values and additional standard values
- o With track changes on easy to verify
- o BioGrace Calculation rules
- o User manual

- Status
  - Version 4c has been recognised by EC as Voluntary scheme
  - Version 4c has small changes compared to version 4b (which was published until now)
  - Tool will be online www.biograce.net
  - After the updates from EU (with new chains) the tool will be updated

Contents

Comparison of tools

BioGrace	Spanish tool	UK tool
Add or modify chains	No new or modifying chains	Add or modifying chains
Functional unit: **MJ biofuel / bioliquid** (final product)	**Functional units:** Different sometimes (other input values compared to BioGrace)	**Functional unit:** Different sometimes (other input values compared to BioGrace)
NUTS input data can be used	Upload of NUTS results Spain	Upload of NUTS results Europe
List of standard values, user defined, additional stan. values	List of standard values	List of standard values and user defined
Objective: transparency of annex V values & actual calculations	Objective: Help stakeholders in Spain (especially farmers and small biofuel companies)	Objective: Reporting under RTFO

BIOGRACE II

Harmonised Greenhouse Gas Calculations for Electricity, Heating and Cooling from Biomass

GHG calculations under RED and FQD

4. Calculation rules with some examples

John Neeft
Agency NL
GHG calculation course for verifier trainers

Contents

- Some comments before starting
- BioGrace calculation rules (version 4c)
- Some questions / exercises to practice

Some comments before starting

- BioGrace GHG calculation tool has been recognised by the European Commission
- As a result of evaluation, some calculation rules have changed compared to version 1b
  - In this presentation, version 4c will be presented

Some comments before starting

- In previous public version of BioGrace GHG calculation tool (version 4b – Public), numbering of the different elements was not yet the same:
  - BioGrace Excel tool – version 4b – Public
  - BioGrace calculation rules – version 1b – Public
  - BioGrace user manual – version 1b – Public
- In recognised version of BioGrace GHG calculation tool (version 4c – Public), numbering has been updated:
  - BioGrace Excel tool – version 4c
  - BioGrace additional standard values – version 4c
  - BioGrace calculation rules – version 4c
  - BioGrace user manual – version 4c

BioGrace calculation rules

1. Introduction
   The BioGrace GHG calculation rules are in line with the methodology as given in Annex V.C of the RED and in the communication ….., with one exception as explained in footnote 14 (electricity mix).

2.1.1 If the BioGrace Excel tool is used, the BioGrace calculation rules shall be respected. An auditor checking actual calculations shall not approve the calculations when the calculation rules were not respected.

2.1.2 Actual calculations shall be made with the version "for Compliance" of the Excel tool in which the "track changes" option is always turned on.

BioGrace calculation rules

2.2.1 BioGrace harmonised list of standard values

2.2.2 BioGrace list of additional standard values

2.2.3 Standard value for fertiliser

} See rule document

2.3 Cut-off criteria

"*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*"

This rule includes a table with mass and energy thresholds, see document

BioGrace calculation rules

2.4 Combining disaggregated default values and actual values

This is 1:1 following RED article 19

2.5 Use of starting values in the BioGrace GHG calculation tool

Summary: when making an actual calculation for one process step, starting values may be kept for another process step

"When changing a starting value into an actual value, all other starting values in that part of the biofuel production chain (either cultivation, processing or transport) shall be changed into actual values as well, including the starting values of other steps within the same part of the biofuel production chain (either cultivation, processing or transport)."
Exception: distribution of fuel from depot to filling station

BioGrace calculation rules

2.6 Using the result(s) from previous and partial GHG calculations

"In order to use the result from previous partial GHG calculations in the BioGrace Excel tool these previous partial calculations shall have been made using BioGrace"

Unless another voluntary scheme including calculation software will be recognised for making actual GHG calculations

2.6 Use of the sheet "user specific calculations"

"The BioGrace Excel tool contains a sheet "User specific calculations" which allows users of the tool to make company- or user-specific calculations, such as converting company- or user-specific data into the format in which the data can be entered into BioGrace."

BioGrace calculation rules

- 3.1 Field N_2O emissions
- 3.2 Use of average values
- 3.3 Use of aggregated or measured values
- 3.4 Non artificial fertilizer
- 3.5 Actual input data for use of fertilisers

(3.1–3.4:) See rule document

BioGrace calculation rules

4.1 Use of actual values

"Actual values for emissions from processing steps (ep in the methodology) in the production chain must be measured or based on technical specifications of the processing facility"

4.2 Allocation } See rule document

BioGrace calculation rules

4.3 Electricity use

"*Emissions from using grid electricity shall be calculated from the average emission intensity for the country in which the electricity is taken from the grid. Country-average emission intensities for electricity shall be taken from the BioGrace list of additional standard values. It is not allowed to use the average emission intensity for the EU electricity mix.*[14] "

[14]: *This rule therefore deviates from "Communication on the practical implementation …. [OJ C160, page 8]" which states that the most logical choice is to take the average emission intensity for the EU. The reason for deviating from "the most logical choice" from the Communication, is that under other voluntary sustainability schemes it is allowed the use the national average emission intensity also for EU countries and because BioGrace aims to avoid disharmonised calculation rules.*

BioGrace calculation rules

4.4 Emissions of N_2O, CH_4 and CO_2 from the production unit

4.6 Emissions from process heat

} See rule document

4.5 Handling of residues and waste

"…… Waste and residues leave the system without any GHG emissions.
Waste and residues used for biofuel production have zero GHG emissions up and until the point of collection. ……"

What is a residue or waste can be different from one member state to another.
This will lead to difficulties when verifying actual calculations !

RTFO Guidance - Wastes and residues

Valid from 15 December 2011 - v4.5

This document contains lists of biofuel feedstocks which the Administrator has assessed and categorises them according to whether, in the Administrator's view, they are products or other materials such as wastes and residues which double count under the RTFO. Materials listed in Tables 2-4 receive two RTFCs for every litre/kg of biofuel. It should be used in conjunction with the RTFO Guidan... 8 of the... wastes...

This do... change... latest v...

Table 1- Products

Material	Description	Valid from
Virgin oils	Including, but not limited to, oils derived from palm, soy...	15/12/11
Tallo... fats) ... 2[1]		
Tallow (anima... fats) category 3		

Table 2 - Residues from agriculture, aquaculture, forestry and fisheries

Material	Description	Valid from
Forest... residu...		15/12/11
Arbori... residu...		...1

Table 3 - Wastes & processing residues

Material	Description	Valid from
Waste wood	The treatment of waste wood in the RED GHG...	15/12/11
Used cooki... (UCO...		

Table 4 - Non-food cellulosic and ligno-cellulosic material

Material	Description	Valid from
Miscanthus	This is a non-food material commonly grown as an energy crop	15/12/11
Shor... rotati... copp...		

Table 5 - Other materials

Material	Description	Valid from
Yellow grease	Yellow grease is the US term for used cooking oil but can be used for a wider range of materials including tallow for which particular requirements apply. Where suppliers have...	15/12/11

BioGrace calculation rules

5 Land use change

"For determining if the bonus for restored degraded land 29 g CO_{2eq}/MJ shall apply, the definitions laid down by the COM of degraded land and heavily contaminated land must be considered [8].

For the calculation of carbon stock emissions from land use change, the rules lain down in Commission decision on guidelines for the calculation of land carbon stocks for the purpose of Annex V of Directive 2009/28/EC [OJ L151, page 19] shall be used. A template for this is included in the BioGrace Excel sheet."

"[8] The Commission has not yet defined degraded land or heavily contaminated land (September 2012). The degraded land bonus can only be applied once the European Commission has finalised the definition of degraded land."

BioGrace calculation rules

6.1 Excess electricity

6.2 Soil carbon accumulation via improved agricultural methods

} See rule document

Some questions / exercises to practice

1. A company makes an actual calculation and contracts you to verify. At this moment of time, do you have to take into account the calculation rules (and, if so, which version)?

   Answer: Yes (rule 2.1). Version 4c of the rules apply

2. A company uses BioGrace to make actual calculations and ISCC to verify sustainability. The company argues that it should follow all ISCC rules, even if they contradict BioGrace rules. Is that correct?

   Answer: No. Rule 2.1.1: BioGrace calculation rules are binding

Some questions / exercises to practice

3. A company makes an actual calculation and provides you with an Excel file (copy of BioGrace Excel tool) with calculations made without track changes turned on. What to do?

Answer: You are allowed to refuse to verify until the company provides an Excel sheet with the whole calculation being made with track changes turned on. See rule 2.1.2

4. A company uses BioGrace to make actual calculations and uses a long list of user defined standard values which are all lower than the BioGrace standard values. What do you do?

Answer: Ask for proof that these specific inputs were used and ask for reliable information showing how these values were determined. If not provided, you cannot further verify

Some questions / exercises to practice

5. A company makes a calculation for FAME from rapeseed using the BioGrace Excel tool with disaggregated default values for cultivation and transport. The company only changes all the input data for the esterification process, and leaves the input values / starting values for the oil mill and for the refining untouched. Do you allow that this is done?

Answer: This is not in line with the recognised version 4c of the calculation rules (see rule 2.5)
It was in line with version 4b

Some questions / exercises to practice

6. A farmer makes an actual calculation for cultivation of sugar beet using the BioGrace Excel tool. He uses measured (farm based data) for yield, fertiliser, pesticides, seeds and diesel use, and a literature value (incl. reference) for N_2O field emissions. Do you agree with this?

Answer: You should not. If actual data are used for cultivation, also the N_2O field emission should be based on these actual data.

Some questions / exercises to practice

7. A farmer makes an actual calculation for cultivation of sugar beet using the BioGrace Excel tool. He uses measured (farm based data) for yield, fertiliser, pesticides, seeds and diesel use, and a calculated value (using the BioGrace Excel sheet) for N_2O field emissions.
   He has used manure (organic fertiliser) only and has calculated zero emissions for the use of the manure.
   Do you agree with this?

Answer: You should agree to this, manure leads to zero emissions as it is a residue (see rule 3.3). You should check the calculation of the N_2O field emissions as manure leads to higher N_2O field emissions as compared to synthetic nitrogen fertiliser.

Some questions / exercises to practice

8. A company makes an actual calculation for FAME from rapeseed. It is demonstrated that the rapeseed cake has been sold as animal feed replacing soybean meal and a GHG credit for the rapeseed cake is calculated, which equals the GHG emission of the soy bean cake being replaced. Do you agree?

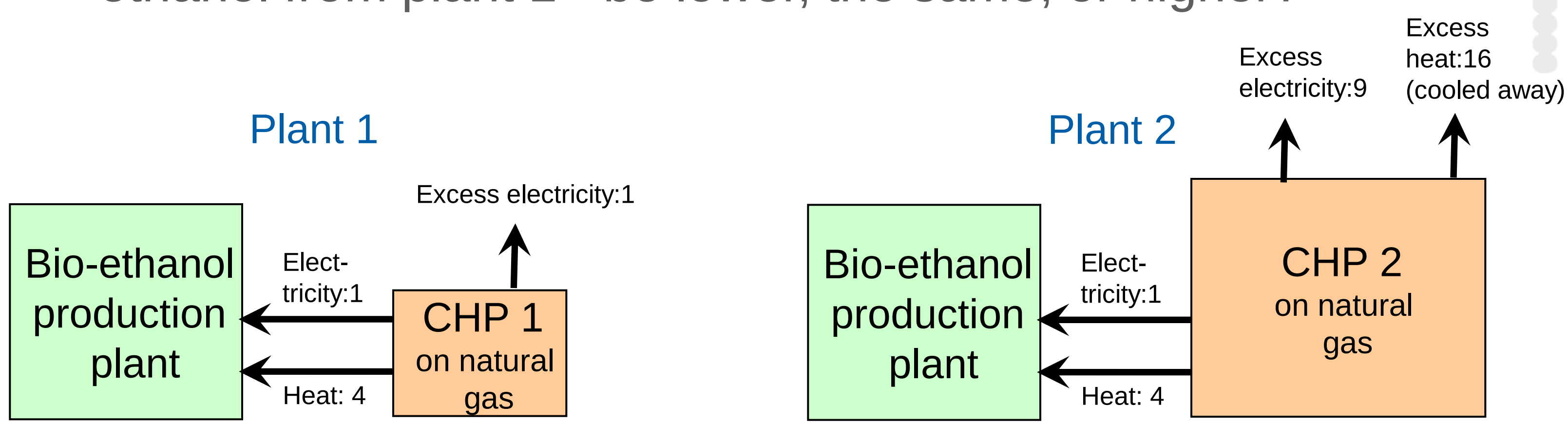
Answer: No, this is the substitution method for taking into account the co-product rapeseed cake. Allocation based on energy content should be used (rule 4.2.1).

9. In an actual calculation electricity is taken from the grid in the UK. The average GHG emissions from electricity in the UK is being used to calculate the emissions. Is that correct?

Answer: Yes (see rule 4.3).

Some questions / exercises to practice

10. The only difference in the two calculations below is that CHP 2 is five times larger than CHP 1. Will the GHG performance of ethanol from plant 2 - in comparison to the performance of ethanol from plant 1 - be lower, the same, or higher?



Answer: The performance will be the same, as only that part of CHP 2 will be taken into account that is needed to supply the heat for the ethanol plant, which is 1/5 of CHP 2, resulting (again) in an excess electricity of 1. See rule 6.1

Thank you for your attention

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