

BIOGRACE

Harmonised Calculations of
Biofuel Greenhouse Gas Emissions in Europe



March 2012

BioGrace

Publishable final report



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1 Executive Summary

1.1 Objectives of the BioGrace project

The overall objective of the project was to harmonise the European calculations of biofuel GHG emissions that have to be made to comply with the Renewable Energy Directive (RED) and the Fuel Quality Directive (FQD).

In more detail the objectives of the BioGrace project were:

- A. to make transparent how the RED default values are calculated;
- B. to facilitate economic operators to make actual calculations;
- C. to cause that GHG calculations as being performed under the RED and FQD are harmonised (one set of input data leads to one result, irrespective of which tool is being used);
- D. to widely disseminate the results.

1.2 Achieved results

Results achieved during the BioGrace project are:

- An excel-based GHG calculation tool has been build which shows, for the 22 biofuel production pathways listed, how the default values in Annex V.A and V.D of the RED were calculated.
- In addition to the excel-based GHG calculation tool, a list of standard values, a list of additional standard values, a set of calculation rules and a user manual were made. Together they allow economic operators to make actual calculations.
- National biofuel GHG calculation tools have been harmonised; they give the same result as the Excel BioGrace GHG calculation tool. Moreover, policy makers in all 27 EU member states have been requested to make reference to one harmonised set of standard values, causing harmonisation of GHG calculations. This has been done in 7 member states, with some more to follow soon.
- The project results have been widely disseminated through a website, a leaflet, newsletters, workshops and targeted presentations at conferences and meetings. Based on feedback from stakeholders it was concluded that the dissemination has been successful.

The project consortium's conclusion is that the action succeeded in reaching its objectives A, B and D. Objective C was partly reached; see also lessons-learned number 2 and 3 under paragraph 2.5 below.

1.3 Activities and impact after the end of the project

Activities planned after the end of the project are:

- The project website will be kept on-line in the coming years;
- The project's main deliverables (the GHG calculation tool, calculation rules and list of standard values) will be kept up-to-date;
- Trainers of auditors will be trained how to make and check calculations (this is part of the follow-up project BioGrace-II).

2 Overview of the project

2.1 Key project data

Key data of the BioGrace project are the following:

Name

Full project name: *Biofuel Greenhouse gas emissions: Align Calculations in Europe*
Project acronym: BioGrace

IEE subsidy

Contract number: IEE/09/736/SI2.558249
Project duration: April 1, 2010 – March 31, 2012

Project coordinator

Organisation: Agency NL
Coordinator name: John Neeft

Project partners

Agence de l'environnement et de la maitrise de l'energie (ADEME), France
Bioenergy 2020+ GmbH (BE2020), Austria
Bio Intelligence Service (BIO IS), France
Research Centre for Energy, Environment and Technology (CIEMAT), Spain
Energy, Management and Information Technology Consultants S.A. (EXERGIA), Greece
Institute for Energy and Environmental Research (IFEU), Germany
Swedish Energy Agency (STEM), Sweden

Contact details of the coordinator and the project partners are listed in Annex I

Website

www.BioGrace.net

2.2 Background and objectives

In 2009 the European Union set legislative sustainability criteria for biofuels as part of the Renewable Energy Directive (2009/28/EC, RED) and the Fuel Quality Directive (2009/30/EC, FQD). The greenhouse gas (GHG) emission saving achieved by biofuels must be at least 35% compared to fossil fuels; this requirement rises to at least 50% by 2017, and 60% by 2018 for biofuels produced in new installations.

The RED and FQD include a methodology for GHG calculations which should be followed when making GHG calculation. However, this methodology is not enough to guarantee a fair level of playing field among actors of the market. Many different parameters, choices and data enter into such a complex calculation. All these can lead to biased comparison between results and to heavy auditing burden on economic operators. It can possibly discredit the whole sustainable policy implementation process.

Such problems were discussed at a policy maker workshop in early June 2009. Policy makers from 9 EU Member States and from the European Commission concluded that among the

possible measures to cope with these problems, one of the most appropriate solutions would be to produce and publish a complete set of standard values and to refer to this from national legislation implementing the RED and the FQD.

This workshop marked the start of the project BioGrace. Following the workshop, the BioGrace project proposal was submitted into the 2009 Intelligent Energy for Europe (IEE) programme. After a positive evaluation and contract negotiations the BioGrace project started April 1, 2010.

The overall objective of the BioGrace project was to harmonise the European calculations of biofuel GHG emissions that have to be made to comply with the Renewable Energy Directive (RED) and the Fuel Quality Directive (FQD).

The six objectives of the BioGrace project (from the description of work) were:

1. to create a uniform and transparent basis for European GHG calculations under the RED and FQD;
2. to cause that biofuel policy makers in European Member States include this uniform and transparent basis in their national legislation that implement the RED and the FQD;
3. to create complete transparency in GHG calculations for each biofuel production pathway as mentioned in Table A of RED Annex V and FQD Annex IV;
4. to allow relevant stakeholders to calculate actual values by providing software tools (Excel based calculation sheets and user-friendly GHG calculators);
5. to cause that existing user-friendly GHG calculators give the same results; and
6. to cause that the products (basis for calculation, transparent GHG calculations and harmonised GHG calculators) are known by relevant stakeholders throughout Europe.

During the project these have been summarised as

- A. to make transparent how the RED default values are calculated (objective 3);
- B. to facilitate economic operators¹ to make actual calculations (objective 4);
- C. to cause that GHG calculations as being performed under the RED and FQD are harmonised (one set of input data leads to one result, irrespective of which tool is being used) (objectives 1, 2 and 5);
- D. to widely disseminate the results (objective 6).

2.3 Overview of results

The following results have been achieved during the BioGrace project (between brackets the paragraph or chapter in which these results are described in more detail):

- A **list of standard values** has been made and published (paragraph 3.1).
- GHG calculations that led to RED Annex V values have been made transparent, and stakeholders have been facilitated making GHG calculations, by publishing the **BioGrace excel-based GHG calculations** on our website. All 22 biofuel production pathways of

¹: The term "economic operator" is being used in the RED and refers to all actors in the biofuel production chain: farmers growing biofuel feedstocks, biofuel producers, biofuel blenders etc.

RED Annex V are reproduced. The excel sheets allows stakeholders to make actual calculations (paragraph 3.2).

On April 15, 2011 version 4 has been send to the European Commission with the request to recognise it as a voluntary scheme under Directive 2009/28/EC. The project consortium received an answer to this request in the form of an assessment in the last two weeks of the project (paragraph 3.5).

- **Calculation rules** and a **user manual** to the BioGrace excel-based GHG calculations were made and published on the website (paragraphs 3.3 and 3.4).
- The BioGrace **website** www.BioGrace.net was put on-line, a **leaflet** was made, and **presentations** were held at 12 European conferences (chapter 6).

Besides, the project was presented at a number of meetings with industrial biofuel associations, biofuel regulators (REFUREC) and with organisations involved in standardisation (CEN TC 383).

- **Eleven workshops** were organised and held.

Two workshops were organised from Work package 2 “Uniform and transparent basis for European GHG calculations”. The first workshop was held for selected policy makers to discuss the problem and proposed solution (June 29, 2010, Utrecht), the second for GHG calculation experts (September 23, 2010, Heidelberg).

Two workshops were organised from Work package 5 “Involvement of European biofuel policy makers”. These workshops were organised to inform policy makers and request them to make reference to the BioGrace standard values (product of WP2). These workshops were organised in Stockholm (November 12, 2010) and Athens (November 25, 2010).

Seven workshops were organised in WP6 “Communication”. These were public workshops for any stakeholder interested and, therefore, attracted larger audiences as compared to the other workshops. Audiences ranged from 23 to 150 participants with 468 participants in total. These workshops were held in Vienna (February 16, 2011), Utrecht (March 21, 2011), Heidelberg (April 14, 2011), Paris (May 19, 2011), Athens (May 26, 2011), Stockholm (May 31, 2011) and Madrid (June 1, 2011) (chapter 6).

- **Outreach to stakeholders.** With the workshops and presentations a large share of the European biofuel stakeholders was reached. Additional stakeholders will be reached when the Commission decides to accept BioGrace as a voluntary sustainability scheme.
- **Harmonisation of GHG calculations** was reached by causing that national GHG calculators in Germany, Netherlands, Spain and UK were slightly modified. These four tools now give the same results. Harmonisation was also aimed for by having member states refer to the BioGrace standard values from national legislation or technical guidances. Up to March 2012, 7 of the 27 member states did do so, 5 are planning to do so, 8 were requested to do so and are considering and 7 were reached but are not going to make this reference. It is clear that we caused some harmonisation Europe, but that full harmonisation has not yet been reached (chapters 4 and 5).

2.4 Communication with others organisations

The BioGrace project has established contacts with:

- LNEG (Portugal) and DfT/RFA/E4Tech (UK) which were performing GHG calculations for their national governments but who are no partners in this project.
- European biomass associations. Agency NL has organised a meeting in Brussels on May 27, 2010 to inform Concaawe, EBB, eBio, Eppoa, Eubia, Europia, European biogas and Fediol on the harmonisation of GHG emissions.
- The JEC consortium.
- The European Commission, DG Energy and DG Climate.
- The EUCAR consortium (presentation in Brussels on Sept, 23, 2010).
- CEN TC 383 in general and WG2 of this TC in particular.
- The voluntary certification schemes 2BSvs, Bonsucro, Greenergy, ISCC, NTA8080/8081, RBSA, and RSB

These contacts were aimed at informing the other organisations on the BioGrace project, in part as to cause that they become multipliers in our communication to stakeholders, and in part to discuss with them (for instance RFA/E4Tech, JEC, EC, CEN TC 383 and RSB) on harmonisation of GHG calculations.

2.5 Main lessons learned

The three main lessons learned as emerging from the project are:

- It is time-consuming to find out every detail of GHG calculations and align it. Alignment of calculations was needed between the BioGrace GHG calculation tool and calculations that have been performed by JRC and their partners, and between national GHG calculators and the BioGrace tool;
- It is rather difficult to reach policy makers in all 27 member states and have them commit to make reference to the BioGrace standard values from their national legislation. During this action the project partners found that there are at least three causes for this: *(i)* policy makers change position frequently, *(ii)* in many EU member states the implementation of the RED was performed later than was foreseen at the start of this project; and *(iii)* policy makers are reluctant to discuss their work with people outside the authority frame.
- The final decision on harmonisation of standard values is with the European Commission. From this project we learned that we could address the issue and make it clear to companies and to national and European policy makers, but that we cannot fully cause harmonisation. The final step is in the hands of the Commission and can to our view be done in two ways: either (1) publish a short list of the most important standard values as part of (the to be updated) RED Annex V; or (2) make sure that GHG calculation tools give the same results (by ensuring that they use the same standard values) when evaluating voluntary schemes in the process of recognition.

3 BioGrace GHG calculation tool

This chapter gives the details on all the elements of the BioGrace GHG calculation tool, which are the list of standard values and the list of additional standard values, the excel-based calculation tool, the calculation rules and the user manual. The latest versions of the tool and the individual products can be found on the BioGrace website www.BioGrace.net. The earlier versions of the standard values and GHG calculation tool are also still available on the website at <http://www.biograce.net/content/ghgcalculationtools/oldversions>.

3.1 Standard values

During the work of the BioGrace consortium on GHG calculation tools, it was well understood that different GHG calculation tools can only give the same result if the tools use the same standard values. Standard values are defined (by BioGrace) as numbers that are necessary to make the GHG calculations and that are considered to be constant as they normally cannot be influenced by the person making the GHG calculation (an actor in the biofuel production chain). Standard values include (i) (conversion) factors such as GHG emission coefficients (direct and indirect emissions of CO₂, CH₄ and N₂O of the use of 1 MJ of natural gas or of the use of 1 kg of N-, P- or K-fertiliser); (ii) lower heating values (LHV's) of feedstocks, co-products and products; (iii) fuel efficiencies of trucks and ships; and (iv) typical values for CH₄ and N₂O emissions for trucks, ships, boilers, CHP plants and gas engines. Some of the standard values (for instance the GHG emission coefficients) have themselves been determined by small LCA analyses, which (for the values that BioGrace did use) were performed by the JEC consortium². The consequence of this is that some of the standard values will be updated in the future, for instance when the Commission will update the RED and when JRC of the JEC consortium have updated the LCA analysis in which the standard values were determined.

Of course, the standard values are average and sometimes somewhat conservative numbers. When respecting certain rules, users of the BioGrace GHG calculation tool are allowed to use own standard values (which are called “user defined standard values” in the tool). More details on the rules under which this is allowed, and on how to do so, can be found in the BioGrace calculation rules and in the user manual.

In the BioGrace project, two lists of standard values were produced as is explained in the following two paragraphs 3.1.1 and 3.1.2.

²: Consortium of Joint Research Centre (JRC), EUCAR and CONCAWE. More details on this consortium and on the Well-to-Wheel study is available at <http://iet.jrc.ec.europa.eu/about-jec/>

3.1.1 List of standard values

The BioGrace list of standard values contains the standard values that were derived from the database “E3database”. They are exactly the same values as the values that JRC used to make its calculations to supply the Commission with input to determine the RED Annex V GHG default values.

Similar to the four versions of the BioGrace GHG calculation tool (see paragraph 3.2.1) the BioGrace consortium developed four versions of the list of standard values. The current version 4 is available through <http://www.biograce.net/content/ghgcalculationtools/standardvalues>. There is a version in Excel, and also two versions (a complete one and a shorter one with the main values) in Word. The three older versions of the standard values are also available through the website.

The list of standard values is included (as a separate and protected sheet) in the excel BioGrace GHG calculation tool.

3.1.2 List of additional standard values

During the project, the BioGrace consortium received questions on what would be the standard values for inputs that were not used to calculate the RED default values, and hence are not included in the list of standard values. As a result, the consortium decided to develop a list of additional standard values which can also be found on the BioGrace website. These values can be used for making actual calculations when respecting the BioGrace calculation rules.

The list of additional standard values is available on the BioGrace website, the direct link to the list is <http://www.biograce.net/content/ghgcalculationtools/additionalstandardvalues>.

3.2 Excel based calculation tool

One of the main products of the BioGrace project is the Excel based GHG calculation tool. The latest version 4 of this tool is included in a zip file also containing the BioGrace GHG calculation rules (see paragraph 3.3) and the user manual (see paragraph 3.4).

3.2.1 Four versions of the tool

In the course of the BioGrace project, four versions of the GHG calculation tool were developed. This gradual development allowed the project partners to present the tool to stakeholders during the policy maker, GHG expert and public workshops in the project (see Chapter 6) and to receive feedback on the tool. Version 1 of the tool was put on the website in June 2010 (so within three months after the start of the project), version 2 was published in September 2010,

version 3 in December 2010, version 4 in April 2011 and an improved version 4b in September 2011.

The latest public version (version 4b – public) can be found on the GHG calculation page of the BioGrace website: <http://www.biograce.net/content/ghgcalculationtools/excelghgcalculations>. Also the older versions 1, 2, 3 and 4 are still available from the BioGrace website.

In the last months of the project, work was started preparing a fifth version of the BioGrace GHG excel tool which will be published once the European Commission has updated RED Annex V.

3.2.2 BioGrace GHG calculation tool serves two functions

The BioGrace GHG calculation tool was made to serve two separate functions:

1. Make transparent the GHG calculations that led to RED Annex V values

JRC has made the GHG calculations as input for the Commission, which led to the GHG default values in RED Annex V. On the website of JRC an Excel file has been published with the input data leading to the RED default values³. Several GHG calculation experts have found, however, that it is not obvious to replicate the RED default values. Therefore, this has been done by BioGrace. The BioGrace GHG calculation tool shows how – using the JRC input values – the RED default values (or in fact the not yet rounded numbers as given in the JRC file) can be reproduced with an accuracy of about 0,05 g CO_{2,eq}/MJ_{biofuel}. The figure below shows the BioGrace GHG calculation tool and how – for the pathway FAME from rapeseed – the results of the BioGrace calculation (left red circle) can be compared with the outcome of the JRC calculations (right red circle).

³: This excel file can be downloaded from http://re.jrc.ec.europa.eu/biof/html/input_data_ghg.htm

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

Version 4b - Public

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_{cc}				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			1,02
Esterification	17,61	95,7%	16,84			17,88
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 degrade)	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

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

Emission reduction

Fossil fuel reference (diesel)	83,8 g CO _{2,eq} /MJ
GHG emission reduction	38%

Calculations in this Excel sheet.....

- strictly follow the methodology as given in Directives 2009/28/EC and 2009/30/EC
 - follow JEC calculations by using GWP values 25 for CH₄ and 298 for N₂O
- As explained in "About" under "inconsistent use of GWP's"

Calculation per phase	Track changes: OFF	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							
Cultivation of rapeseed		Quantity of product			Calculated emissions			Info	
		Yield			Emissions per MJ FAME			per kg rapeseed	per ha, year
					g CO ₂	g CH ₄	g N ₂ O	g CO _{2,eq}	g CO _{2,eq}
Yield									
Rapeseed	3.113 kg ha ⁻¹ year ⁻¹	73.975 MJ _{Rapeseed} ha ⁻¹ year ⁻¹							
Moisture content	10,0%	1.000 MJ / MJ _{Rapeseed, input}							
Co-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	83,40
									259,7

In the versions 3, 4 and 4b of the BioGrace GHG calculation tool, all 22 biofuel production pathways of RED Annex V are reproduced (versions 1 and 2 contained less pathways).

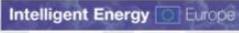
2. Allow stakeholders to make actual calculations

The BioGrace GHG excel tool allows stakeholders to make actual calculations. This can be done by replacing the input values by actual input values (yields, amounts of fertiliser inputs, amounts of process energy (natural gas, electricity), and/or transport distances as measured from actual biofuel production plants/pathways). The actual inputs can be inputted in the white fields of the tool. In the figure below, only a small part of the calculations are shown, the Excel sheet is larger than shown in the figure. The tool also allows users to add extra inputs (add a row) and to change the name of the input, in which case also a corresponding emission factor has to be given in the sheet "user defined standard values". Inexperienced users can use the user manual to get familiar with the tool.

When making actual calculations, the tool allows fixing "disaggregated default values" for the steps cultivation, processing or transport (change the "A" in the upper red ellipse in the figure below into a "D"). This will allow keeping the RED Annex V.D disaggregated default values even when making changes to the values in the calculations that would normally change the outcome. The tool also allows keeping

track of changes when clicking on the orange button in the lower red ellipse in the figure below. This will facilitate auditors checking actual calculations.



www.biograce.net


Production of FAME from Rapeseed (steam from natural gas boiler)
Version 4b - Public

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			1,02
Esterification	17,61	95,7%	16,84			17,88
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 degrade)	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

Allocation factors	Emission reduction
Extraction of oil	Fossil fuel reference (diesel)
61,3% to Rapeseed oil	83,8 g CO _{2,eq} /MJ
38,7% to Rapeseed cake	GHG emission reduction
Esterification	38%
95,7% to FAME	
4,3% to Refined glycerol	

Calculations in this Excel sheet.....

strictly follow the methodology as given in Directives 2009/28/EC and 2009/30/EC

follow JEC calculations by using GWPs values 25 for CH₄ and 298 for N₂O

AS explained in "About" under "Inconsistent use of GWPs"

Calculation per phase

Cultivation of rapeseed		Quantity of product	Calculated emissions	Info
Yield		Yield	Emissions per MJ FAME	per kg rapeseed
Rapeseed	3.113 kg ha ⁻¹ year ⁻¹	73.975 MJ _{Rapeseed} ha ⁻¹ year ⁻¹	g CO ₂ g CH ₄ g N ₂ O g CO _{2,eq}	per ha, year
Moisture content	10,0%	1,000 MJ / MJ _{Rapeseed, input}		g CO _{2,eq} kg CO _{2,eq}
Co-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	83,40 259,7

Track changes: OFF

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

3.3 Calculation rules

When making GHG calculations many detailed questions arise. The choices made in answer to these questions all influence the final result of the calculations. The GHG methodology in Annex V.C of the RED prescribes which choices to make for some of the questions. Other questions are not covered by this methodology of the RED, and therefore BioGrace has made a list of calculation rules which in part rephrases the Annex V methodology and in part adds new and more detailed rules that have to be followed when using the BioGrace GHG calculation tool.

The BioGrace GHG calculation rules are fully in line with the methodology as given in Annex V.C of the RED and with the communication and decision from the European Commission: Communication on the practical implementation of the EU biofuels and bioliquids sustainability scheme and on counting rules for biofuels [OJ C160, page 8] and 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 (2010/335/EU) [OJ L151 page 19].

It is made clear that when using the BioGrace Excel tool, the calculation rules must be followed (see the lowest box with the yellow background on the figure on the previous page). One of the calculation rules is that a verifier may not approve an actual calculation made with the BioGrace GHG calculation tool when the rules are not followed, in other words: the rules are binding.

Other rules deal with the use of the standard values (emission factors, LHV's, transport efficiencies), the cut-off criterion (how small should an emission be before it can be neglected), how to use the disaggregated default values, use of average, aggregated or measured input numbers to use, etc.

The calculation rules have been shared and discussed with CEN TC 383 working group 2 on Greenhouse Gas emissions, with the UK regulators who also have rules under the Renewable Fuels Transport Obligation (RTFO) and in a workshop with GHG calculation experts.

The BioGrace calculation rules are part of the GHG calculation tool that has been submitted to the European Commission for recognition as a voluntary scheme.

3.4 User manual

The user manual is a document describing how the Excel BioGrace GHG calculation tool works and how actual calculations can be made (replacing input numbers, inserting new input materials or creating a modified or new pathway). It explains the functions of the tool and how the Excel spreadsheet is structured.

The user manual also describes the "special" sheets in the Excel BioGrace GHG calculation tool, which are the sheets to perform calculations on land use change, improved agricultural management and N₂O field emissions following the IPCC Tier 1 method.

Last but not least the user manual gives some background on the history of BioGrace.

Also the BioGrace user manual is part of the GHG calculation tool that has been submitted to the European Commission for recognition as a voluntary scheme

3.5 Request to recognise the BioGrace GHG calculation tool as a voluntary scheme

On April 15, 2011 version "4b – Public" of the BioGrace GHG calculation tool has been sent to the European Commission with the request to recognise it as a voluntary scheme on the basis of Articles 18.4 – 18.6 of Directive 2009/28/EC (RED). At the time of writing of this report (end of March 2012) the Commission replied with a first assessment of BioGrace and a request to respond to a number of requirements and recommendations. As a result, the evaluation of the Commission was ongoing at the time of writing of this report.

Since the requirements and recommendations by the Commission will result in changes being made to the Excel GHG calculation tool, the user manual and the calculation rules, the Commission will be asked to further assess a version “4c – Public”. The final version “4c – Public” will be published on the BioGrace website when all necessary changes for the assessment have been made and when the Commission has positively assessed BioGrace and has decided to recognise BioGrace as a voluntary scheme.

4 Harmonisation of GHG calculation tools

4.1 Objectives of harmonisation of GHG calculation tools

The objective of this part of the BioGrace project was to ensure that different GHG calculation tools give the same result when making a calculation using the same input values. At the start of the BioGrace project, this was certainly not the case, and different tools gave quite different results (up to 35% difference, see also the paper on the comparison between the BioGrace and the RSB tool⁴).

The GHG tools to be considered by BioGrace were the national GHG tools that had been developed or were being developed when the BioGrace project started. These are the national GHG calculation tools for biofuels in Germany, Spain, The Netherlands and UK. These tools can be found on the following websites:

- Germany: <http://ifeu.de/nachhaltigkeit/pdf/THG-Rechentools-Testversionen%20Juli2011.zip>
(Pre-versions of calculators, note that the results shown below correspond to the final versions which will be published soon)
- Netherlands: <http://www.agentschapnl.nl/en/programmas-regelingen/determine-biofuel-greenhouse-gas-emissions-production-transport-fuels-made-bio>
- Spain: <http://www.idae.es/index.php/relcategoria.1037/id.686/re/menu.322/mod.pags/mem.detalle>
(Spanish and English version - language choice after start of tool)
- UK: <http://www.dft.gov.uk/publications/carbon-calculator>

Moreover, BioGrace also attempted to harmonise tools that were developed by multistakeholder initiatives (like RSB – the Roundtable on Sustainable Biofuels) or by companies (like the tool that is used by Abengoa as linked to their recognised voluntary scheme RED Bioenergy Sustainability Assurance).

⁴: Hennecke et al, 2011, "Biofuel greenhouse gas calculations under the EU Renewable Energy Directive – A comparison of the BioGrace tool vs. RSB-RED tool (first results)" in conference proceedings of the XIX ISAF International symposium on alcohol fuels.

4.2 How the work was performed

The owners of three of the four national tools (those from Germany, Spain and The Netherlands) were also project partners in the BioGrace project. The owners of the UK GHG calculator joined this work on a voluntary basis.

The owners of the tools compared the results of their tools with the result from the BioGrace Excel GHG calculator and tracked down the cause for differences. Often the cause for a different outcome was the use of a different standard value (like a different emission factor or a different LHV value). The owners of the national tools have adjusted their tools so that the outcome became the same.

4.3 Results

After four rounds of finding differences and errors full harmonisation of the four national tools and the BioGrace GHG calculation tool was accomplished. All five tools give the same result, the results are the same within 0,6 g CO_{2,eq}/MJ as is shown in the table below.

Biofuel production pathways	Table A RED Annex V/FQD Annex IV	Diferences with BIOGRACE tool			
	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

The differences between the BioGrace tool plus the four national tools and the GHG values as listed in RED Annex V.A are on average slightly larger because the values in the RED are rounded. Besides, two pathways (Corn-to-Ethanol and Waste-Oil-to-FAME) show larger

differences when comparing the RED values with the results from BioGrace and the results from the four national GHG calculators. These two results are shown and/or further explained in the complete table with results, which is available on the BioGrace website

[http://www.biograce.net/app/webroot/files/file/BioGrace_Comparison%20 table showing that national GHG calculators give the same results.pdf](http://www.biograce.net/app/webroot/files/file/BioGrace_Comparison%20table_showing_that_national_GHG_calculators_give_the_same_results.pdf)

4.4 Conclusions

From the work as described above it was concluded that BioGrace has been successful in harmonising biofuel GHG calculation tools as being developed nationally in Germany, Spain, The Netherlands and UK. Biofuel GHG calculation tools that have been developed by companies or multistakeholder initiatives like Abengoa or RSB have not been harmonised.

5 Harmonisation through reference from national legislation in 27 EU member states

5.1 Objectives of reference from national legislation

The main objective of this part of the BioGrace project was to ensure that the same standard values will be used for actual calculations being performed to comply with the sustainability criteria under the RED and the FQD. In this way all biofuel GHG calculation tools (national tools but also tools developed by companies and multistakeholder initiatives, see the previous chapter 4) would be required to use the same standard values and hence would give the same or almost the same result. The goal of this work therefore was to have national legislation include or make reference to a common list of standard values.

The subgoals of this work were the following:

- To identify the MS policy makers who are responsible of the sustainability criteria implementation.
- To get in contact with these policy makers and send them information about the BioGrace project goals and aims.
- To gather information about the implementation status of the RED and the sustainability criteria for liquid biofuels and certain bioliquids and to cause that policy makers make reference to the BioGrace standard values in their national legislation or in guidance documents..

5.2 How the work was performed

The work was led by the partner Swedish Energy Agency (STEM). All the other partners have given input. The policy makers were contacted by the project partners by telephone, email or by ordinary mail. All contacted policy makers received a letter about the BioGrace project aims, goals and other relevant information about the project. Some of the policy makers were visited (more details given below).

Three policy maker workshops were organised by the BioGrace partners in The Netherlands, Sweden and Greece. The aim of these workshops was to involve policy makers, make them familiar with the problem of non-harmonised calculations and request them to ensure that the same set of standard values is used. In total 21 biofuel policy makers participated to the workshops. More information about these workshops can be found on the BioGrace project web-site at <http://www.biograce.net/content/workshops/workshopoverview>.

Moreover, six visits to MS policy makers were carried out by the project partners and the project coordinator. The aim of these visits was the same as the aim of the workshops described above. Policy makers were visited that could not come to the workshops. During all visits, the

policy makers were asked to consider making reference to the BioGrace standard values from legislation and/or Technical Guidances to legislation.

5.3 Results

By March 2012 seven (7) MS have included the BioGrace standard values into Technical Guidances or have made reference to these standard values from (explanatory text to) their legislation: 1) Czech Republic, 2) Denmark, 3) the Netherlands, 4) Romania, 5) Slovakia, 6) Spain and 7) UK. Five (5) other MS are planning to do so, 8 were requested to do so and are considering and 7 were reached but are not going to make this reference. It is clear that BioGrace caused some harmonisation in Europe, but that full harmonisation has not yet been reached.

As part of the five MS that are planning to make reference, in Germany the “BLE Guidance for implementing the German Ordinances according to RED” will be updated and will adopt the BioGrace standard values. In Ireland, reference to the BioGrace standard values will be made from a technical specification that is to be written by NORA (National Oil Reserves Agency).

5.4 Conclusions

From the work as described in this chapter it is concluded that it was difficult to engage and contact relevant MS policy makers. There are several reasons to that, for instance it was difficult to get information of the policy makers who were directly involved (i.e. are responsible of the action / are able to make decisions about it) in the RED related activities incl. the sustainability criteria. Therefore, some effort was allocated to locate the relevant policy makers. The most difficult task has been to convince the relevant policy makers to make a reference.

During the execution of the BioGrace project a number of policy makers and scheme owners of voluntary sustainability schemes indicated that the only way to reach harmonisation would be that the Commission decides that a certain set of standard values should be used. This can possibly be done during the upcoming amendment of RED Annex V. This signal has been communicated by the project coordinator to the policy makers of the European Commission who are working on the update of RED Annex V.

Although the aim of this part of the BioGrace project was not fully achieved, the activities performed led to a better understanding of the project as a whole amongst the contacted and participating MS policy makers. Policy makers from all 27 EU member states know about, and in many cases are familiar with, the BioGrace GHG calculation tool and the BioGrace standard values.

6 Dissemination of results

Dissemination activities in the BioGrace project were aimed as a broad dissemination of the project results amongst the stakeholders. Stakeholders to the BioGrace project are policy makers, companies and auditors/verifiers that are working with biofuel sustainability criteria under the RED and FQD.

Dissemination of results was achieved via our website, a leaflet, newsletters, workshops and targeted presentations at conferences and meetings, as is explained in the following paragraphs.

6.1 Website

Early in the project the website www.BioGrace.net was created. It was launched in June 2010 (within three months after the start of the project). The website contains all results of the project, including all the products as presented in this chapter and in this report. The website is self-explaining.

6.2 Leaflet

The project leaflet explains the project and its deliverables in short. The leaflet has been printed and was distributed at workshops and conferences, and is also accessible on-line via the link <http://www.biograce.net/content/informationleaflet>. The online version is also available in French, German, Greek and Spanish.

6.3 Newsletters

During the project lifetime five electronic newsletters have been made and distributed to more than 600 subscribers. The newsletters announced new versions of the tool and explained what improvements were made, which caused that our stakeholders visited the website and downloaded the new version of the BioGrace GHG tool.

The newsletters can be found on the website via <http://www.biograce.net/content/maillinglist>.

6.4 Workshops

BioGrace has organised seven large public stakeholder workshops, the table below gives details on their dates and locations. The workshops had similar agenda's, and covered national policies to implement the RED in the morning session (policy makers from 3 or 4 member states being present) and the BioGrace project and calculation tool in the afternoon, incl. a detailed calculation session.

Date	Location	Organiser	Number of participants
2011-02-16	Vienna, Austria	BE2020	52
2011-03-21	Utrecht, The Netherlands	ANL	147
2011-04-14	Heidelberg, Germany	IFEU	59
2011-05-19	Paris, France	ADEME	43
2011-05-26	Athens, Greece	EXERGIA	23
2011-05-31	Stockholm, Sweden	STEM	45
2011-06-01	Madrid, Spain	CIEMAT	99

In total, 468 persons visited the workshops. It was concluded - based on evaluation sheets that participants filled out at the end of the workshops - that most participants were satisfied with the workshops. It was also concluded that, although more than half of the participants indicated that they were able to use the BioGrace calculation tool, many stakeholders would need some more instructions or (self)study before they are fully able making calculations themselves. This is not within the objective of the BioGrace project: the project delivers a user-friendly tool including user manual, stakeholders should learn to work with the tool outside the project.

On top of the public workshops as presented above, BioGrace organised three workshops for policy makers in Utrecht, Stockholm and Athens, and one workshop for GHG calculation experts in Heidelberg. Details on all these workshops including workshop reports can be found on the website via the link <http://www.biograce.net/content/workshops/workshopoverview>.

6.5 Presentations at conferences and meetings

During the BioGrace project the project coordinator and the project partners have presented the BioGrace project and its products at the following conferences:

- 2010-05-05 Prague Bioenergy International Expo & conference 2010
- 2010-09-13 Berlin FAME 2010 / Biofuels Hall of Fame 2010
- 2011-03-24 Rotterdam World Biofuel Markets 2011
- 2011-03-31 Wieselburg Transportation Biofuels Research in Austria 2011
- 2011-06-08 Berlin European Biomass conference and exhibition
- 2011-06-14 Bratislava 45th International Petroleum Conference
- 2011-06-15 Rotterdam European Biodiesel 2011
- 2011-09-15 Brussels 4th Stakeholder Plenary Meeting of the European Biofuels Technology Platform
- 2011-10-12 Verona XIX International Symposium on Alcohol Fuels ISAF 2011
- 2011-11-09 Barcelona F.O. Licht's World Ethanol & Biofuels Conference
- 2012-02-28 Copenhagen Advanced biofuels in a biorefinery approach (IEA Bioenergy Task 39 and 42 meeting and parallel conference)
- 2012-03-13 Rotterdam World Biofuel Markets 2012

Besides, on request BioGrace has given presentations on, and contributed to discussions at a number of meetings organised by industry, associations, biofuel regulators and certification/standardisation initiatives.

6.6 Conclusion from dissemination

The conclusion of the project partners was that dissemination of the BioGrace products was rather successful. This conclusion was based on the following feedback and information received from stakeholders

- We learned that the BioGrace GHG calculation tool including the user manual and calculation rules are used in many countries throughout Europe, in all corners of Europe: western-Europe, South-Europe (Spain and Portugal), Southeast Europe (Greece, Rumania, Ukraine) and Northeast Europe (Poland, Estonia, Finland, Denmark).
- The website and download statistics show that the tool has been widely used. BioGrace project partners have received and answered many questions on details of the GHG calculation tool, showing that these stakeholders have looked deeply into details of the tool.
- Many organisations asked BioGrace project partners to come and present on workshops or conferences. The amount of presentations held at workshops and conferences (12) largely surpassed the amount of presentations scheduled (4).
- Many organisations have asked detailed questions on the GHG calculation tool, on the calculation rules and on the relation of BioGrace as compared to PrEN 16214-4 as developed by CEN TC 383.
- BioGrace was requested to write an article in Biofuels International. The article was published in the March 2012 issue, we got reactions from several stakeholders that they read and appreciated the article.

The BioGrace project partners expect a large rise in website visits and downloads of the BioGrace GHG calculation tool when BioGrace will get accepted as a voluntary scheme.

7 Acknowledgement

The BioGrace project partners would like to make the following acknowledgements:

- We acknowledge the European Commission and EACI (the European Association for Creativity and Innovation) for granting the subsidy under the IEE (Intelligent Energy for Europe) programme, and for the good cooperation during the execution of our project;
- We acknowledge our UK colleagues at the Department for Transport (Keeley Bignal and Aaron Berry) and our colleagues from the Roundtable of Sustainable Biofuels (Mireille Faist, Victoria Junquera Garcia and Jürgen Reinhard) for sharing information to compare/harmonise the UK GHG calculator and for the collaboration in writing an article on the comparison of the RSB and BioGrace tools, respectively.
- We acknowledge our contacts at JRC (Robert Edwards and Alessandro Agostini) and at LBS (subcontracted, Uwe Albrecht and Werner Weindorf) for our good collaboration during this project.

Annexes

Annex I: Contact details

The BioGrace project was performed by 8 project partners from 7 EU member states, as listed in the figure below. The project was coordinated by Agency NL (SenterNovem at the start of the project).



Table 1 below gives the contact details (addresses, phone numbers and e-mail addresses) for the contact persons of the BioGrace project partners.

Project partner	Address	Contact person	Telephone N°	E-mail
ANL (coordinator)	Croeselaan 15, PO Box 8242, 3503 RE Utrecht, The Netherlands	Neeft, John	+31 88 602 2605	john.neeft@agentschapnl.nl
ADEME	avenue du Gresille 20, PO Box 90406, F-49004 Angers, France	Gagnepain, Bruno	+33 (2) 41204218	bruno.gagnepain@ademe.fr
BE2020	Gewerbepark Haag 3, 3250 Wieselburg-Land, Austria	Bacovsky, Dina	+43 741652238-35	dina.bacovsky@bioenergy2020.eu
BIO IS	rue Berthelot 1, 94200 Ivry sur Seine, France	Lavelle, Perrine	+33 1 5390 1180	perrine.lavelle@biois.com
CIEMAT	Avenida Complutense 22, 28040 Madrid, Spain	Lechón, Yolanda	+34 91 3466321	yolanda.lechon@ciemat.es
EXERGIA	Omirou & Vissarionos 1, 10672 Athens, Greece	Komioti, Niki	+30 210 6996185	n.komioti@exergia.gr
IFEU	Wilckensstrasse 3, 69120 Heidelberg, Germany	Fehrenbach, Horst	+49 6221 476716	horst.fehrenbach@ifeu.de
STEM	Kungsgatan 43, 63104 Eskilstuna, Sweden	Matti Parikka	+46 16 544 2177	matti.parikka@energimyndigheten.se

Table 1 – Contact details for the project partners