BIOGRACE

Harmonised Calculations of Biofuel Greenhouse Gas Emissions in Europe

# Introduction to the project BioGrace

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IFEU
Public workshop Heidelberg
April 14, 2011

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# Introduction

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

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

# Introduction

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

| Cultivation of rapeseed | | | Calculated emissions | | | |
|---|---|---|---|---|---|---|
| **Yield** | | | **Emissions per MJ FAME** | | | |
| | | | g $CO_2$ | g $CH_4$ | g $N_2O$ | g $CO_{2,\,eq}$ |
| Rapeseed | 3.113 | kg $ha^{-1}$ $year^{-1}$ | | | | |
| Moisture content | 10,0% | | | | | |
| By-product Straw | n/a | kg $ha^{-1}$ $year^{-1}$ | | | | |
| **Energy consumption** | | | | | | |
| Diesel | 2.963 | MJ $ha^{-1}$ $year^{-1}$ | 6,07 | 0,00 | 0,00 | 6,07 |
| **Agro chemicals** | | | | | | |
| N-fertiliser | 137,4 | kg N $ha^{-1}$ $year^{-1}$ | 9,08 | 0,03 | 0,03 | 18,89 |
| CaO-fertiliser | 19,0 | kg CaO $ha^{-1}$ $year^{-1}$ | 0,05 | 0,00 | 0,00 | 0,06 |
| $K_2O$-fe | | | | | | |
| $P_2O_5$-f | | | | | | |
| Pestic | | | | | | |
| **Seeding material** | | | | | | |
| Seeds- rapeseed | 6 | kg $ha^{-1}$ $year^{-1}$ | 0,06 | 0,00 | 0,00 | 0,10 |

**STANDARD VALUES**

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

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# Why harmonisation of biofuel GHG calculations?

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

**Standard values**

Nitrogen Fertilizer

P fertilizer

K fertilizer

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

Pesticides

Diesel (direct plus indirect emissions)

Natural gas (direct plus indirect emissions

Methanol (direct plus indirect emissions)

**Production of FAME from Rapeseed**

**Overview Results**

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

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

# Why harmonisation of biofuel GHG calculations?

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

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

# Why harmonisation of biofuel GHG calculations?

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

# Formulation of project BioGrace

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

# Contents

# Project BioGrace

**Bio**fuel **Gr**eenhouse Gas emissions:
**a**lignment of **c**alculations in **E**urope

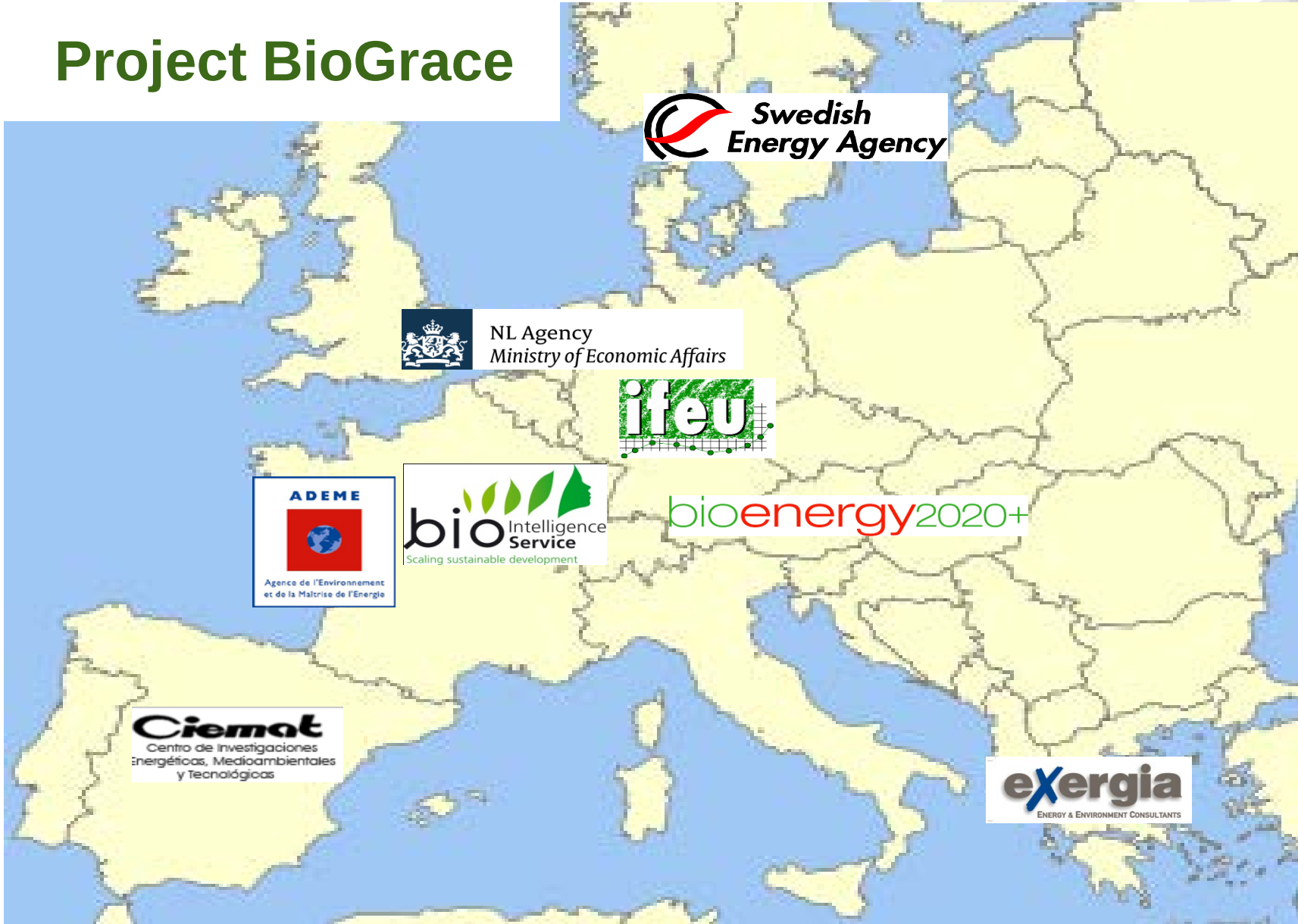
**Aim of project:**

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

**Consortium**

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

# Project BioGrace



# Project BioGrace

Key objectives are:

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

# Project BioGrace

Key objectives are:

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

# Project BioGrace

Key objectives are:

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

# Project BioGrace

Key objectives are:

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

# Project BioGrace

Key objectives are:

1. **Cause transparency**
   **Reproduce biofuel default GHG values (Annex V RED)**
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   **Cause that GHG calculation tools give the same results**
3. **Facilitate stakeholders**
   **Allow relevant stakeholders to calculate actual values**
4. **Disseminate results**
   Make our results public to all relevant stakeholders
   - All information is available through www.BioGrace.net
   - All information is for free !
   - Public stakeholder workshops
     14 April: Heidelberg 19 May: Paris
     26 May: Athens 31 May: Madrid
     1 June: Stockholm

# Contents

# One list of standard values

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

| Cultivation of rapeseed | | | Calculated emissions | | | |
|---|---|---|---|---|---|---|
| **Yield** | | | **Emissions per MJ FAME** | | | |
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| CaO-fertiliser | 19,0 | kg CaO $ha^{-1}$ $year^{-1}$ | 0,05 | 0,00 | 0,00 | 0,06 |
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**STANDARD VALUES**

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

# One list of standard values

## List of standard values

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

We are achieving this by:

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

# One list of

## Version 3 - Public

## Condensed list of standard values, version 3 - Public

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

Two Word versions of this list exist:

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

This file contains the condensed list.

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

### 1 Global Warming potentials

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

### 2 GHG emission coefficients

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

STANDARD VALUES

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

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

# One list of standard values

## List of standard values

- European Commission makes reference to list

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

Datei Bearbeiten Ansicht Chronik Lesezeichen Extras Hilfe

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

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## Renewable Energy

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## Biofuels: Sustainability Criteria

**Commission sets up system for certifying sustainable biofuels**

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

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

### Related documents

- **Communications and Decision**

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

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

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# One list of standard values

## List of standard values

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

# One list of standard values

**List of standard values**

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

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

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

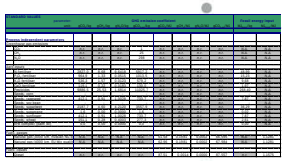
# Project BioGrace

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

# Contents

# Concluding summary

- One biofuel, different GHG calculations => different results
- IEE funded project BioGrace will:
  1. Cause harmonisation
     - Excel tool and GHG calculators give same result
     - All GHG calculations based on one set of standard values
  2. Cause transparency
     in how RED default values were calculated
  3. Facilitate stakeholders
     - Tools that allow own input and/or modifications to pathways
  4. Broadly disseminate results






# *Thank you for your attention*

Intelligent Energy Europe

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# Project BioGrace

- Project coordinator: Agentschap NL (NL Agency)
  Dr. John P.A. Neeft
  e-mail: john.neeft@agentschapnl.nl
- Project partners:
  - ADEME, France (Bruno Gagnepain)
  - BE2020, Austria (Dina Bacovsky)
  - BIO IS, France (Remy Lauranson)
  - CIEMAT, Spain (Yolanda Lechon)
  - EXERGIA, Greece (Konstantinos Georgakopoulos)
  - IFEU, Germany (Horst Fehrenbach)
  - STEM, Sweden (Matti Parikka)
- Project duration: 2 years (April 2010 – March 2012)
- Project website: www.BioGrace.net

# Project BioGrace – project background

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

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

***High Complexity Low***

**Scientific approach:**

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

**Policy approach:**

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