BIOGRACE

Harmonised Calculations of Biofuel Greenhouse Gas Emissions in Europe

The BioGrace Excel GHG calculation tool – Other parts

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Public workshop Utrecht
March 21, 2011

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Introduction

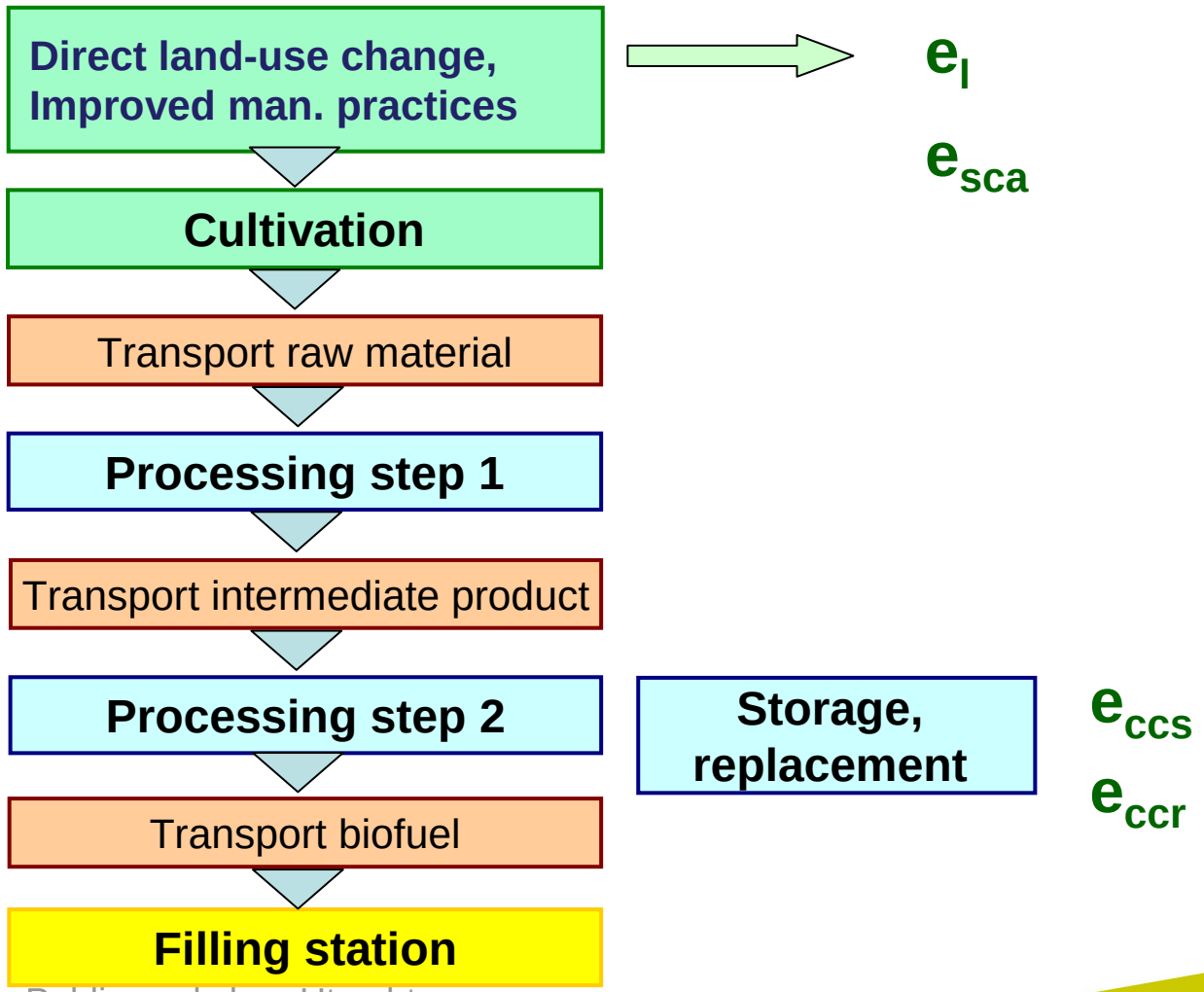
$$E = e_{ec} + e_l + e_p + e_{td} + e_u - e_{sca} - e_{ccs} - e_{ccr} - e_{ee},$$

$ee_{ccs/ccr}$: CO_2 capture, storage or replacement

e_{sca}: Carbon storage from improved agricultural management

e_l: Land use change, following the decision 2010/335/EU

Introduction



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Land Use Change

General principles :

1. Annex V of the RED gives the general calculation guidelines (part C, point 7):

$$e_l = (CS_R - CS_A) \times 3{,}664 \times 1/20 \times 1/P - e_B \ (1)$$

2. Calculation rules are explained in the following the decision 2010/335/EU: *Commission Decision of 10 June 2010 on guidelines for the calculation of land use carbon stocks for the purpose of Annex V of Directive 2009/28/EC.*

   This communication gives:

   - Consistent representation of land carbon stocks
   - Calculation rules
   - Default data for applying this formula (tables)

Land Use Change

General principles :

Two types of calculation are possible :

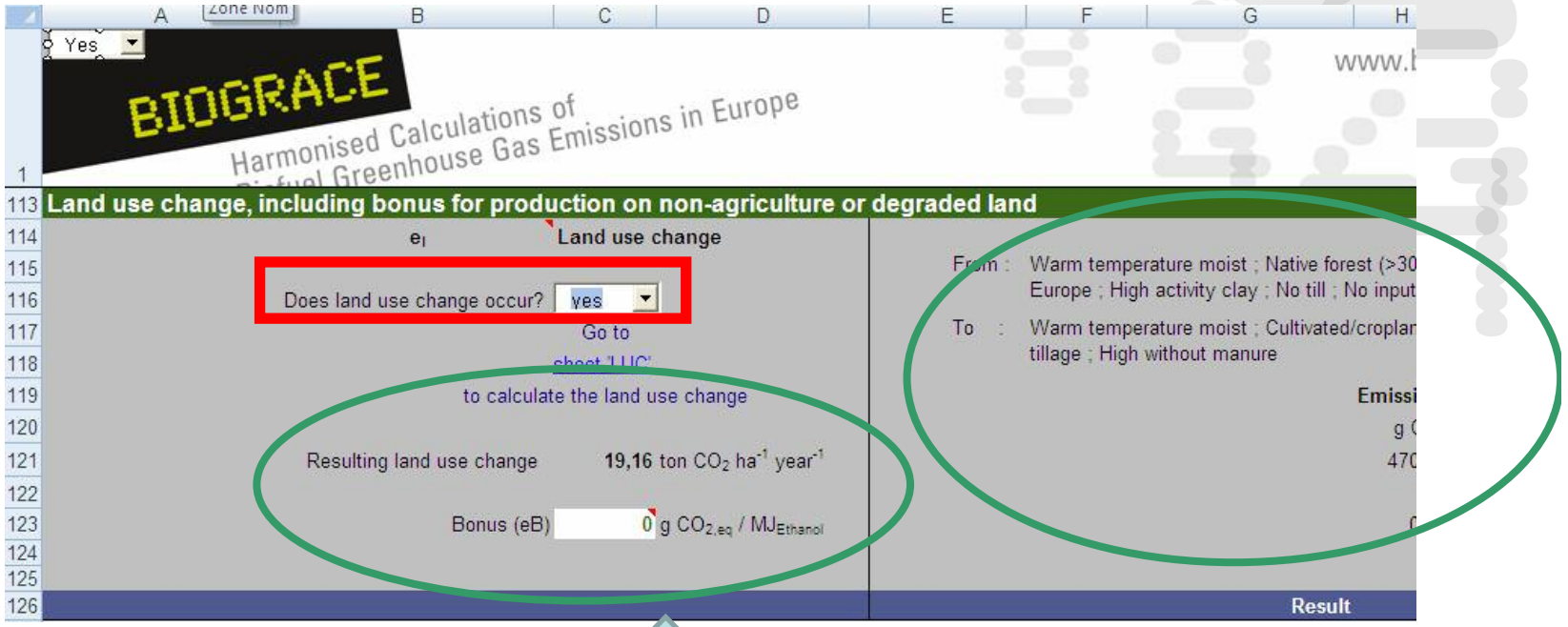
1. *Calculation using default value*

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

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

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

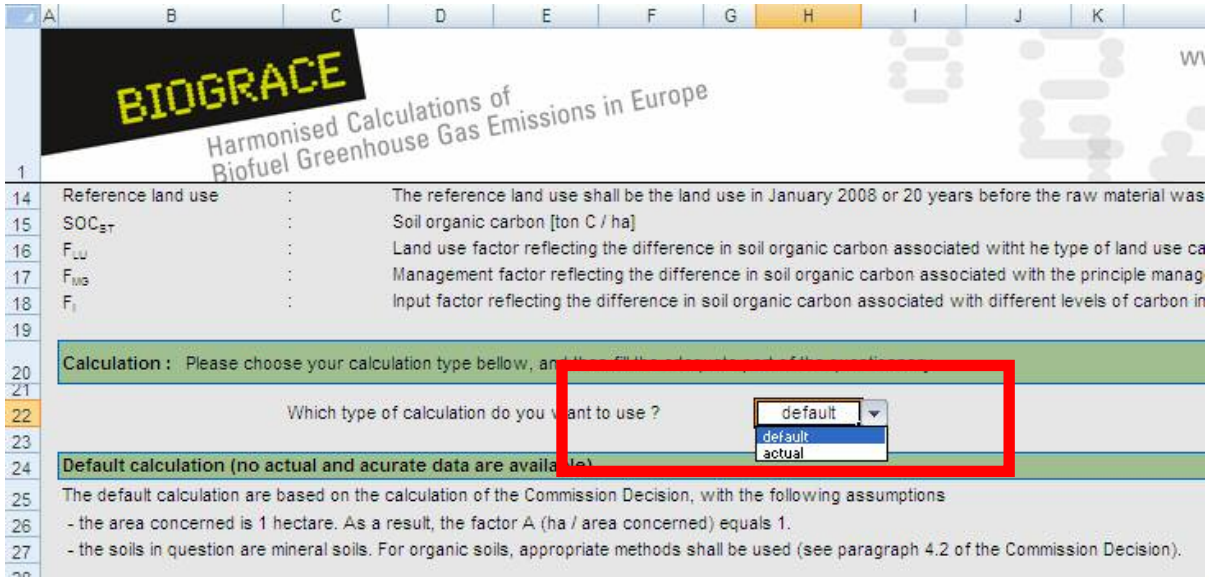
Step 1 : declare LUC in your pathway



Text appear

Step 2 : Go to the LUC excel sheet and read through this sheet. Get the Commission Decision 2010/335/EU with you.

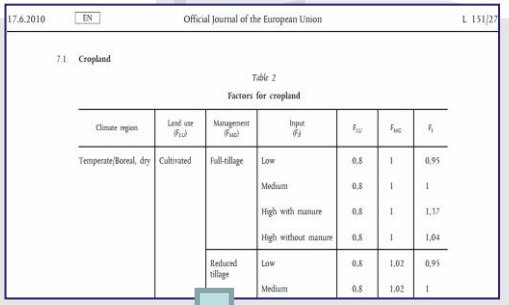
Step 3 : Choose the type of calculation : default or actual and fill the appropriate white cells.



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

CS_A and CS_R are calculated with the following equation: $CS_i = C_{veg} + SOC_{ST} * F_{LU} * F_{MG} * F_I$

	Actual land use	Reference land use
Climate region	Warm temperature moist	Warm temperature moist
Vegetation/crop (land use)	Cultivated/cropland	Native forest (>30% canopy cover)
Above and below ground vegetation		
Ecological zone (if relevant)	-	Oceanic forest
Continent (if relevant)	-	Europe
C_{veg}	0 ton C / ha	84 ton C / ha
Carbon stock in mineral soil		
Climate region	Warm temperature moist	Warm temperature moist
Soil type	High activity clay	High activity clay
Soil management	Full-tillage	No till
Input	High without manure	No input
SOC_{ST}	88 ton C / ha	88 ton C / ha
F_{LU}	0,69	1
F_{MG}	1	n/a
F_I	1,11	n/a


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

7.1. Cropland

Table 2

Factors for cropland

Climate region	Land use (F_{LU})	Management (F_{MG})	Input (F_I)	F_{LU}	F_{MG}	F_I
Temperate/Boreal, dry	Cultivated	Full-tillage	Low	0,8	1	0,95
			Medium	0,8	1	1
			High with manure	0,8	1	1,17
			High without manure	0,8	1	1,04
		Reduced tillage	Low	0,8	1,02	0,95
			Medium	0,8	1,02	1

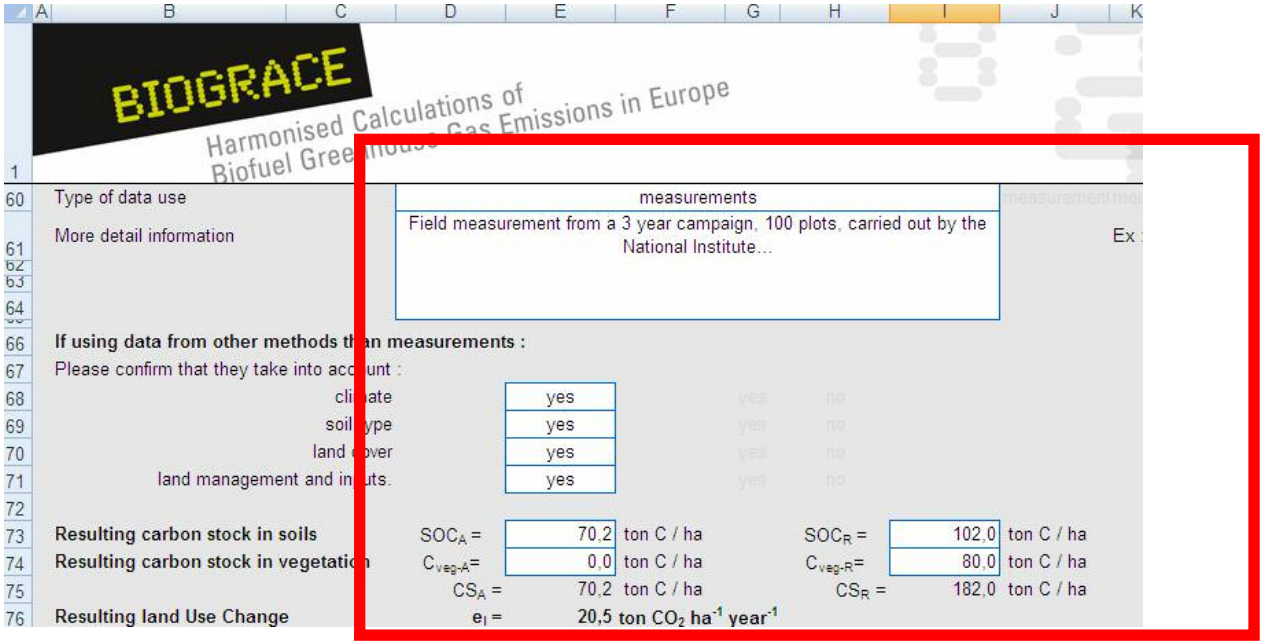
Calculate value according to Chapter 5, or look up val

Determine using paragraph 6.1 of Commission Decisio
Determine using paragraph 6.2 of Commission Decisio
Determine using table 3 of Commission Decision
Determine using table 3 of Commission Decision

Loop up in Table 1 of Commission Decision, using clim
Look up in Tables 2 - 8 of Commission Decision
Look up in Tables 2 - 8 of Commission Decision
Look up in Tables 2 - 8 of Commission Decision

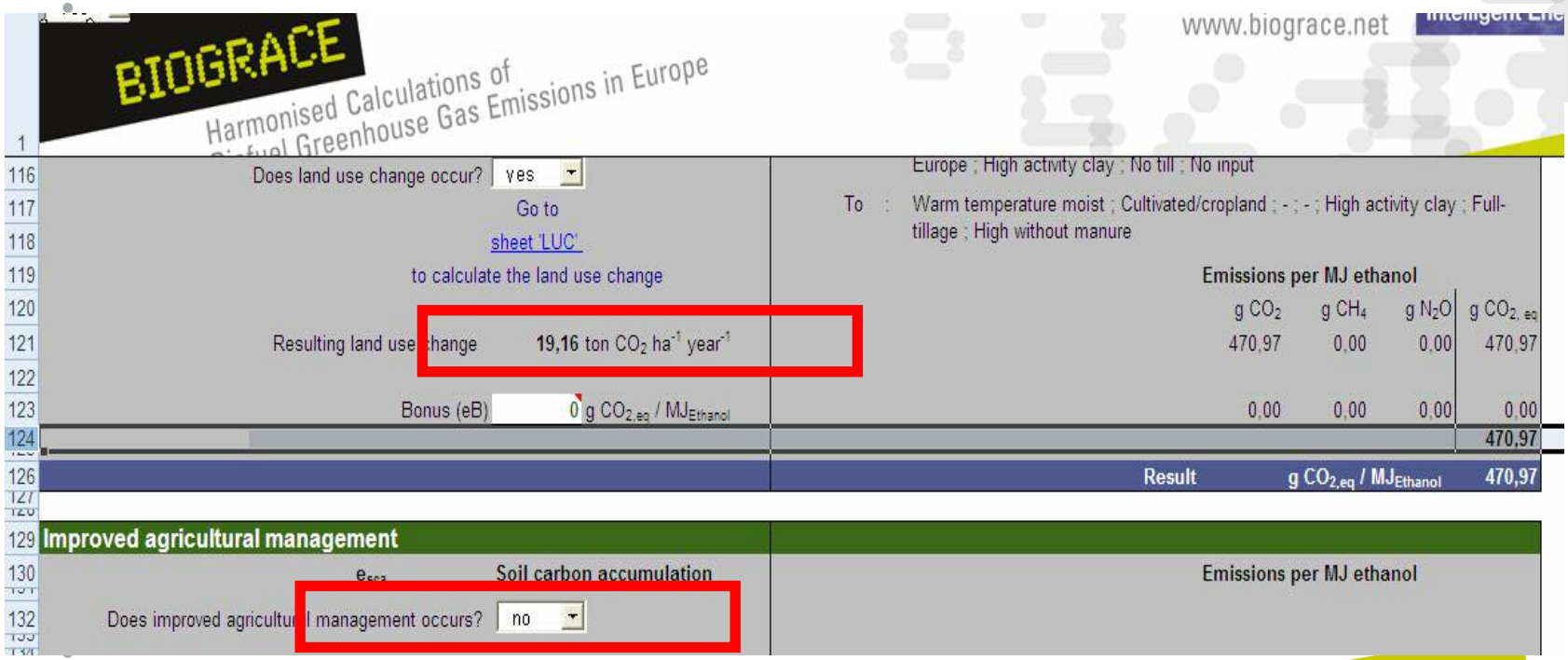
Resulting carbon stock	CS_A =	67,4 ton C / ha	CS_R = 172,0 ton C / ha
Resulting LUC	e_i =	19,16 ton eq. CO_2 / ha / an	

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



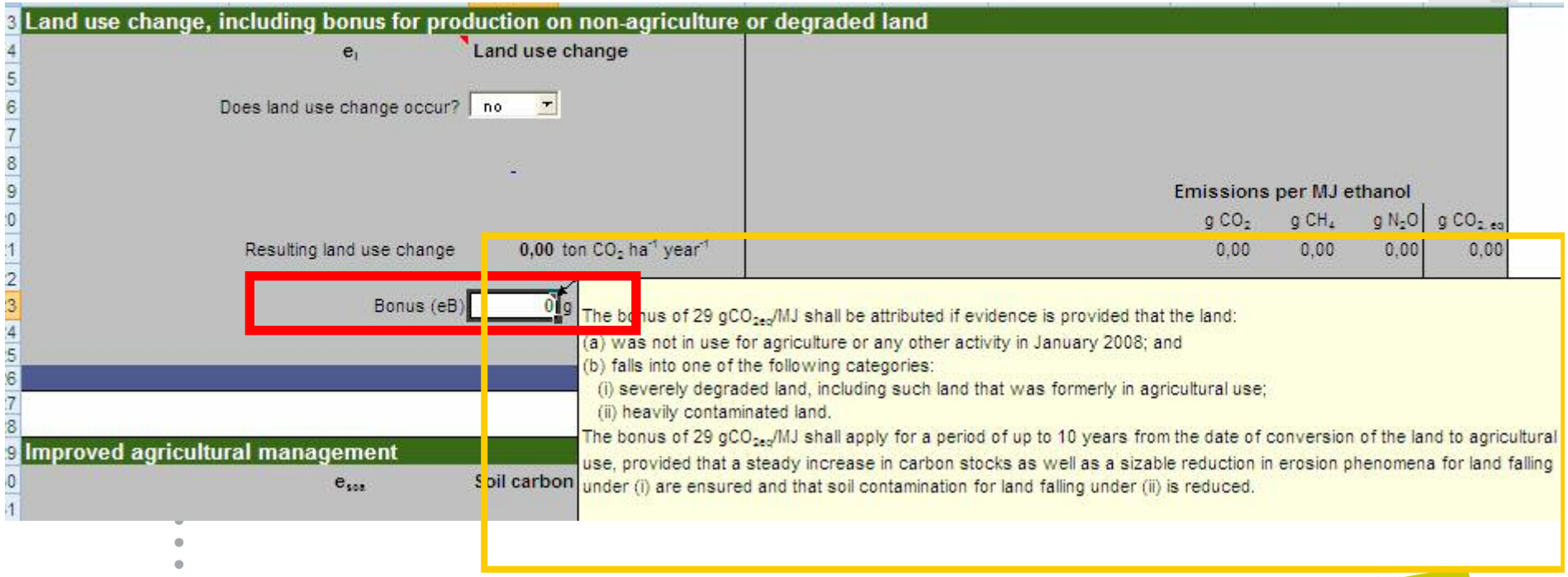
60	Type of data use		measurements						
61	More detail information		Field measurement from a 3 year campaign, 100 plots, carried out by the National Institute…						
66	**If using data from other methods than measurements :**								
67	Please confirm that they take into account :								
68	climate		yes						
69	soil type		yes						
70	land cover		yes						
71	land management and inputs.		yes						
73	**Resulting carbon stock in soils**	SOC_A =	70,2	ton C / ha	SOC_R =	102,0	ton C / ha		
74	**Resulting carbon stock in vegetation**	C_{veg-A}=	0,0	ton C / ha	C_{veg-R}=	80,0	ton C / ha		
75		CS_A =	70,2	ton C / ha	CS_R =	182,0	ton C / ha		
76	**Resulting land Use Change**	e_l =	**20,5 ton CO_2 ha^{-1} $year^{-1}$**						

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



e_b bonus for degraded and contaminated lands :

- A specific line exits within the LUC module of each pathway.
- Explanations on how to use are to be taken from the RED



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Improved Agricultural Management

1. Annex V of the RED has a specific term for carbon stock accumulation thanks to improved practices, but does not give much more explanations on how to calculate it
2. Calculation rules from the Commission Decision can serve as guidelines for making first level calculations
3. As for LUC, actual data can be used to assess them
4. In the BioGrace tool, an e_{sca} sheet exist to carry out the calculation
5. This sheet is build on the same frame than the LUC sheet
6. Don't declare e_{sca} when LUC are already declared (double counting)

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CO_2 storage or replacement

General principles :

1. Annex V of the RED has specific terms for carbon stock accumulation thanks to improved practices, but does not give much more explanations
2. In the BioGrace tool, two modules exist to declare these technological solutions. The value in g CO_2/MJ has to be added
3. Please, keep track of your calculations for verification requirements

43	CO_2 capture and replacement			
44		e_{scr}	Emissions per MJ ethanol	
45		0 g $CO_{2,eq}$ / $MJ_{Ethanol}$		0,00
46			Result g $CO_{2,eq}$ / $MJ_{Ethanol}$	0,00
47				
48				
49	CO_2 capture and geological storage			
50		e_{scs}	Emissions per MJ ethanol	
51		0 g $CO_{2,eq}$ / $MJ_{Ethanol}$		0,00
52			Result g $CO_{2,eq}$ / $MJ_{Ethanol}$	0,00

CO_2 storage or replacement

General principles :

4. Replacement : "*Emission saving from carbon capture and replacement, e_{ccr}, shall be limited to emissions avoided through the capture of CO_2 of which the carbon originates from biomass and which is used to replace fossil-derived CO_2 used in commercial products and services.*"
5. Storage : "*Emission saving from carbon capture and geological storage e_{ccs}, that have not already been accounted for in ep, shall be limited to emissions avoided through the capture and sequestration of emitted CO_2 directly related to the extraction, transport, processing and distribution of fuel.*"

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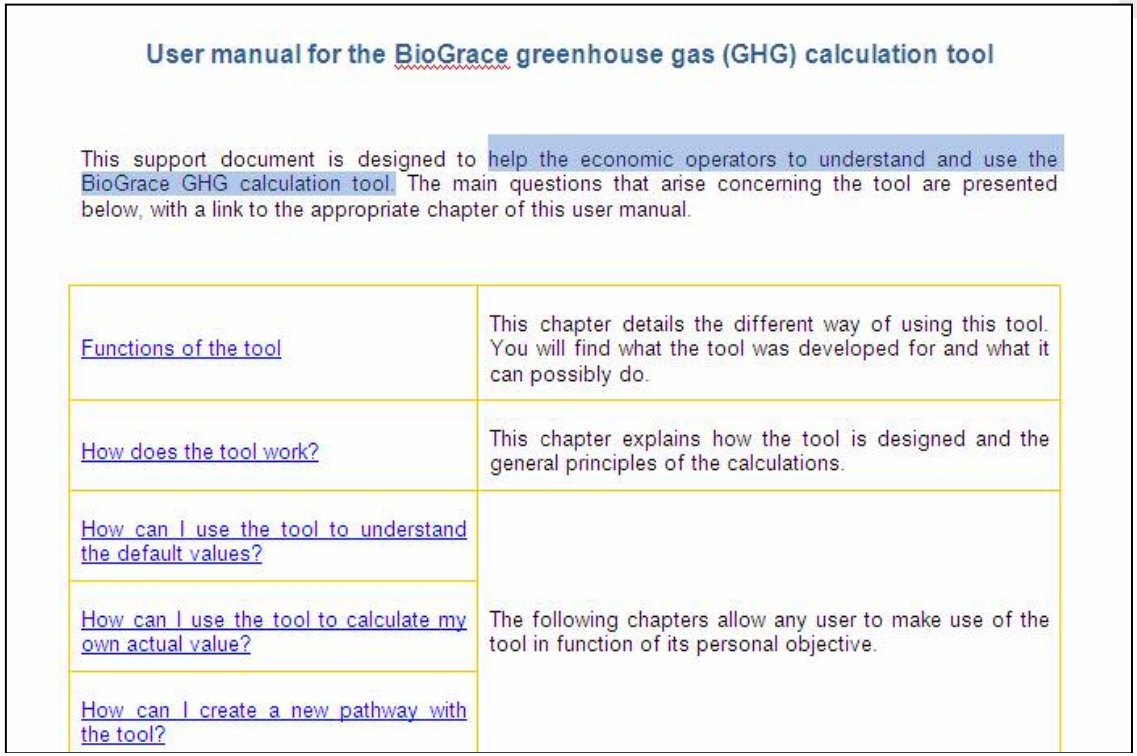
New items in Public version 4

User Manual (or tutorial)

- A detailed tutorial will be provided with the BioGrace tool
- It aims at helping the economic operators to understand and use the BioGrace GHG calculation tool.



User manual for the BioGrace greenhouse gas (GHG) calculation tool

This support document is designed to help the economic operators to understand and use the BioGrace GHG calculation tool. The main questions that arise concerning the tool are presented below, with a link to the appropriate chapter of this user manual.

Functions of the tool	This chapter details the different way of using this tool. You will find what the tool was developed for and what it can possibly do.
How does the tool work?	This chapter explains how the tool is designed and the general principles of the calculations.
How can I use the tool to understand the default values?	The following chapters allow any user to make use of the tool in function of its personal objective.
How can I use the tool to calculate my own actual value?	
How can I create a new pathway with the tool?	

New items in Public version 4

Calculation rules

- Making actual calculations under the RED/FQD requires rules
  - Which input data and standard values are allowed?
  - Cut-off criterion
  - Combination of actual and disaggregated values
- Many of these rules not yet defined
  - More detailed than methodology in RED Annex V.C
  - Some rules given in communications, several are not covered
- BioGrace will make document “calculation rules”
  - To be published as a separate document
  - To be linked to GHG Excel tool
- European Commission will be evaluating rules…
  - … when assessing a voluntary certification scheme after a request for recognition

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Harmonised Calculations of Biofuel Greenhouse Gas Emissions in Europe

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New items in Public version 4

Track changes

- One of the calculation rules:
  - *"Use "track changes" for verification purposes"*

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Harmonised Calculations of Biofuel Greenhouse Gas Emissions in Europe

www.biograce.net

Intelligent Energy Europe

Production of Ethanol from Sugarbeet (steam from NG boiler) Version 4 - Public

Overview Results

All results in g $CO_{2,eq}$ / $MJ_{Ethanol}$	Non- allocated results	Allocation factor	Allocated results	Total	Default values RED Annex V.D
Cultivation e_{ec}				11,3	12
Cultivation of sugarbeet	15,89	71,3%	**11,33**		11,54
Processing e_p				26,4	26
Ethanol plant	37,03	71,3%	**26,40**		26,42
Transport e_{td}				2,3	2
Transport of sugarbeet	1,11	71,3%	**0,79**		0,84
Transport of ethanol	1,10	100%	**1,10**		1,10
Filling station	0,44	100%	**0,44**		0,44
Land use change e_l	0,0	71,3%	0,0	0,0	0
$e_{sca} + e_{ccr} + e_{ccs}$	0,0	100%	0,0	0,0	0
Totals	**55,6**			**40,1**	**40**

Allocation factors	
Ethanol plant	
71,3%	to ethanol
28,7%	to Sugar beet pulp

Emission reduction	
Fossil fuel reference (petrol)	
83,8	g $CO_{2,eq}$/MJ
GHG emission reduction	
52%	

Calculations in this Excel sheet……

- ~~*strictly follow the methodology as given in Directives 2009/28/EC and 2009/30/EC*~~
- ☑ follow JEC calculations by using GWP values 25 for CH4 and 298 for N2O

As explained in "About" under "Inconsistent use of GWP's"

When using this GHG calculation tool, **the BioGrace calculation rules must be respected.**
The rules are included in the zip file in which you downloaded this tool. The rules are also available at www.BioGrace.net

Calculation per phase

Track changes: ON

Cultivation of sugarbeet			Quantity of product		Calculated emissions				Info	
Yield			**Yield**		**Emissions per MJ ethanol**				**per kg sugarbeet**	**per ha, year**
Sugar beet	**70.000**	kg ha^{-1} $year^{-1}$	285.250	$MJ_{Sugar\ beet}$ 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	**75,0%**		1,000	MJ / $MJ_{Sugarbeet,\ input}$						
			0,451	$kg_{Sugarbeet}/MJ_{ethanol}$						

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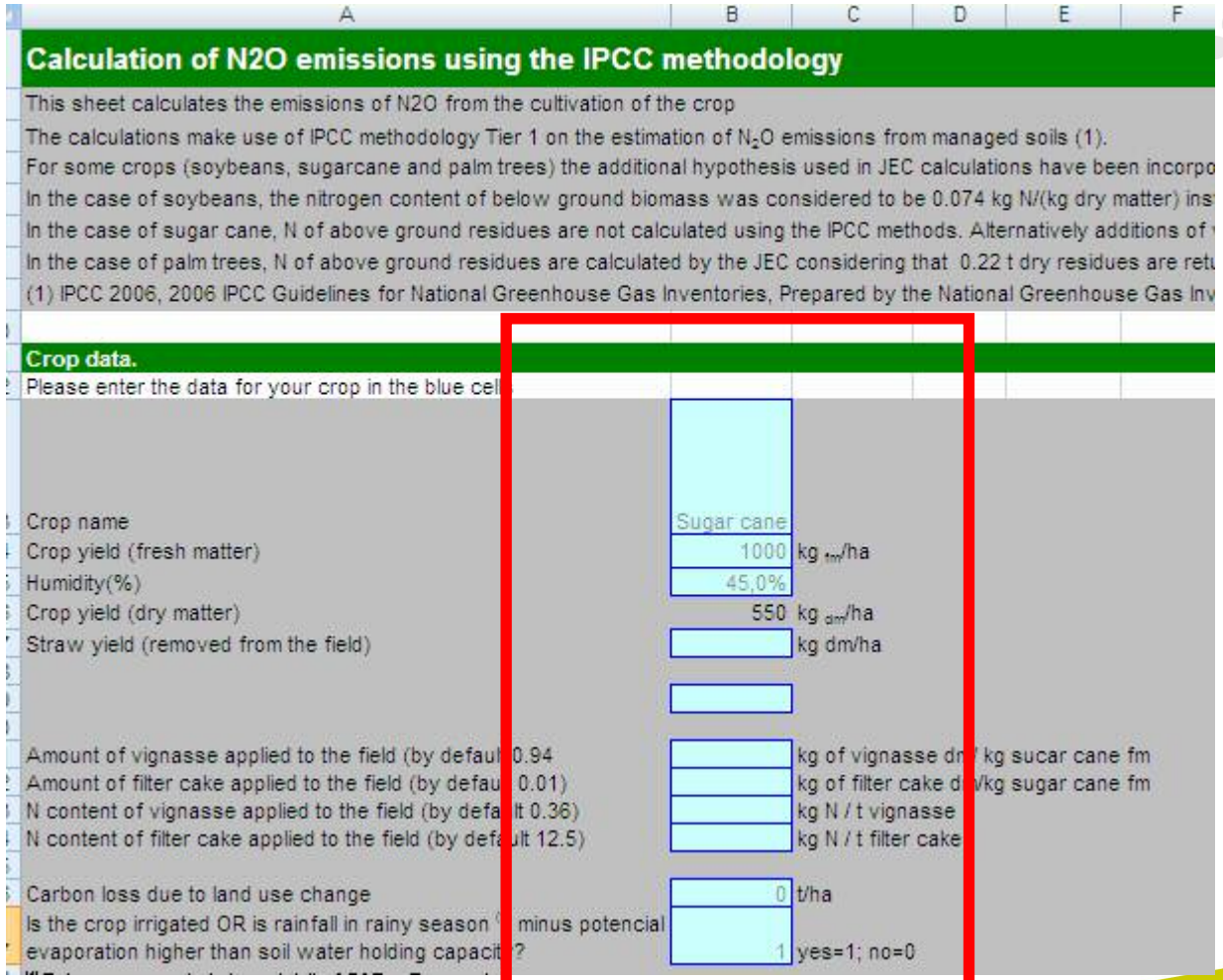
New item in Public version 5

Calculation of N_2O field emissions

1. A major contributors to GHG emissions of most of the pathways
2. Default value : N_2O emissions calculated from a model (DNDC, average EU), except some pathways (IPCC Tier 1 for soybeans, palm trees, sugarcane)
3. For new pathways or when modifying the cultivation data from an existing pathways : BioGrace recommends to use IPCC Tier 1 estimation for this emission
4. BioGrace tool aims to provide an Excel sheet for making N_2O calculations

N_2O emissions : fill in few input data



Calculation of N2O emissions using the IPCC methodology

This sheet calculates the emissions of N2O from the cultivation of the crop
The calculations make use of IPCC methodology Tier 1 on the estimation of N_2O emissions from managed soils (1).
For some crops (soybeans, sugarcane and palm trees) the additional hypothesis used in JEC calculations have been incorpo
In the case of soybeans, the nitrogen content of below ground biomass was considered to be 0.074 kg N/(kg dry matter) ins
In the case of sugar cane, N of above ground residues are not calculated using the IPCC methods. Alternatively additions of
In the case of palm trees, N of above ground residues are calculated by the JEC considering that 0.22 t dry residues are retu
(1) IPCC 2006, 2006 IPCC Guidelines for National Greenhouse Gas Inventories, Prepared by the National Greenhouse Gas Inv

Crop data.

Please enter the data for your crop in the blue cel

Crop name	Sugar cane	
Crop yield (fresh matter)	1000	kg $_{fm}$/ha
Humidity(%)	45,0%	
Crop yield (dry matter)	550	kg $_{dm}$/ha
Straw yield (removed from the field)		kg dm/ha
Amount of vignasse applied to the field (by defaul 0.94		kg of vignasse dr kg sucar cane fm
Amount of filter cake applied to the field (by defau 0.01)		kg of filter cake d /kg sugar cane fm
N content of vignasse applied to the field (by defa lt 0.36)		kg N / t vignasse
N content of filter cake applied to the field (by def lt 12.5)		kg N / t filter cake
Carbon loss due to land use change	0	t/ha
Is the crop irrigated OR is rainfall in rainy season minus potencial evaporation higher than soil water holding capacit ?	1	yes=1; no=0

N_2O emissions

29						
30	**Direct N2O emissions from managed soils (Tier1).**					
31	Please enter the N additions in the form of synthetic or organic fertilizer in the blue cells					
32	**N_2O emissions from N inputs: N_2O_N**					
33						
34	F_{SN}		kg N/ha	N in synthetic fertilizer		
35	F_{ON}		kg N/ha	N in organic fertilizer		
36	F_{CR}		0 kg N/ha	N in crop residues		
37	F_{SOM}		0,00 kg N/ha	N mineralized		
38						
39	EF_1		0,01	0,003	0,03	
40						
41						
42						
43						
44						
45			kg N_2O_N/ha		kg N_2O/ha	
46	$N_2O\_N_{N\ inputs}$		0,00	0,00	0,00	0,00
47						

F_{CR}	N in crop residues		
$AG_{DM(T)}$	0	kg/ha	
$Frac_{Renew(T)}$	1		
$R_{AG(T)}$	0,000		
$N_{AG(T)}$	0		
$Frac_{Remove(T)}$	#DIV/0!		
$R_{BG(T)}$	0,00		
$N_{BG(T)}$	0,000		
F_{CR}	0	kg N/ha	Eq 11.6
	0	kg N/ha	Eq 11.7A

	N_{AG}	slope	intercept	$AG_{DM(T)}$	$(AG_{DM(T)}*100)$	$R_{AG(T)}$	$R_{BG-B:O(T)}$	N_{BG}
Sugar beet	0,016	1,07	1,54	2,13	4,87	3,87	0,2	
Wheat	0,006	1,51	0,52	1,35	3,46	2,46	0,24	
Corn	0,006	1,03	0,61	1,18	3,14	2,14	0,22	
Sugar cane				0,00	1,00	0,00		
Rapeseed	0,006	1,09	0,88	1,48	3,69	2,69	0,22	
Sunflower	0,006	1,09	0,88	1,48	3,69	2,69	0,22	
Soybeans	0,008	0,93	1,35	1,86	4,38	3,38	0,19	
Palm	0,011			0,00	1,00	0,00		

N_2O emissions : direct and indirect emissions calculation

$N_2O_{(L)}$-N	Leaching		
F_{SN}	0	kg N/ha	N in synthetic fertilizer
F_{ON}			
F_{CR}			
F_{SOM}			
$Frac_{LEA}$			
EF_5			

$N_2O_{(ATD)}$-N	Volatilization		
F_{SN}	0	kg N/ha	N in synthetic fertilizer
F_{ON}	0	kg N/ha	N in organic fertilizer
$Frac_{GASM}$	0,2	0,05	0,5
$Frac_{GASF}$	0,1	0,03	0,3
EF_4	0,01	0,002	0,05
	kg N2O_N/ha		
$N2O_{(ATD)}$-N	0,00	0,000	0,000

Indirect N_2O emissions from managed soils (Tier1)				
	kg N_2O_N/ha			kg N_2O/ha
N_2O from atmospheric deposition of N	0,00	0,00	0,00	0,00
$N_2O_{(L)}$-N	0,00	0,00	0,00	0,00

Direct + Indirect N_2O emissions from managed soils (Tier1)							
	kg N_2O_N			kg N_2O			
Total N_2O emissions	0,01	0,00	0,00	0,01	0,00	0,00	per ha
	0,01	0,00	0,00	0,02	0,00	0,00	per kg
	0,0005	0,0000	0,0000	0,00	0,00	0,00	per MJ

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BioGrace as a voluntary scheme

Observations:

- Current voluntary cert. schemes do not include GHG tool
  - ISSC, REDcert, NTA8080, RSPO, RTRS, Bonsucro (BSI)
- European Commission only allows use of GHG tool if it is recognised as a voluntary cert. scheme
- To our knowledge no GHG tools have been send to Commission for recognition
  - Some schemes will be send in, eg. National GHG tools
  - Information on actual developments is scarce
- GHG tool can be used as “add-on” to existing schemes

BioGrace will submit GHG tool to EC for recognition as a voluntary scheme

BioGrace as a voluntary scheme

- BioGrace voluntary scheme will consist of a zip file with
  1. BioGrace Excel GHG tool
  2. BioGrace calculation rules
  3. BioGrace user manual
- BioGrace scheme does not contain requirements on audits and mass balance
  - BioGrace has to be used together with another scheme

Time schedule

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

Thank you for your attention

Intelligent Energy Europe