BIOGRACE II

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

Block 2: Verification of actual calculations

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IFEU
Greenhouse gas calculation course for verifier trainers
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Overview

1. Introduction: verification of actual calculations
2. Exercise on a verification
3. Other tools under the RED and the FQD: $ENZO_2$ and the RSB GHG calculator
4. Calculation example for $ENZO_2$

1. Verification of actual calculations

Elements of a verification

Use of default values

and / or

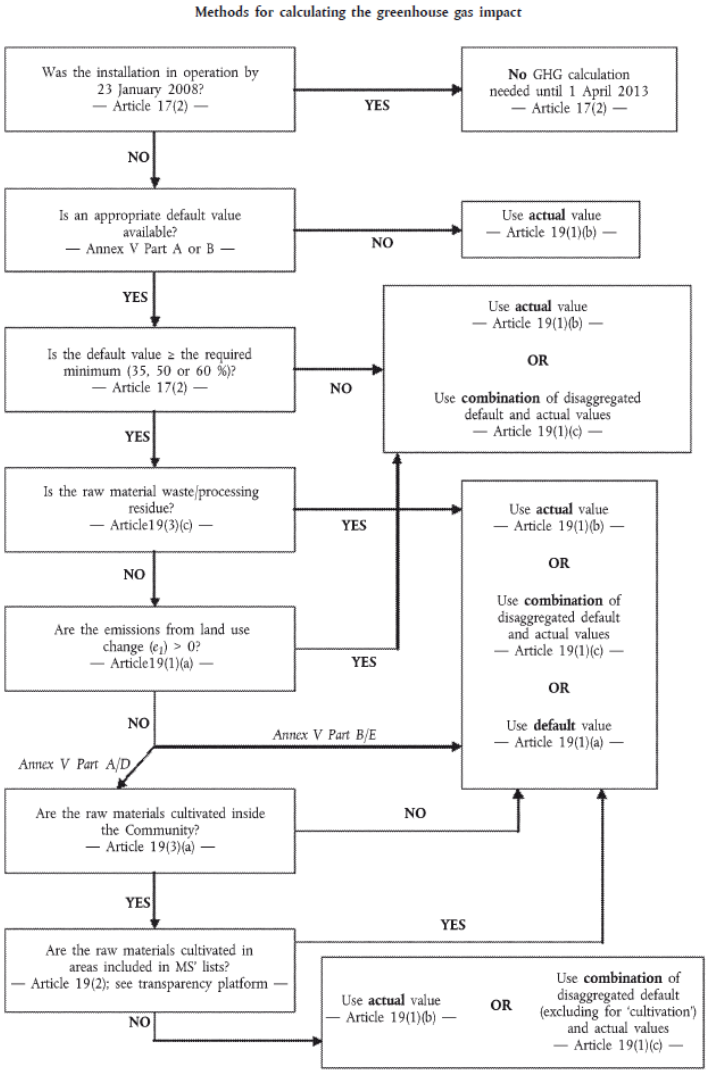
Use of actual values

- Correct application of RED methodology and scheme rules
- Verification of data (input data, standard values, reference values)

Verification of the use of actual vs. default values

When **verifying the use of default values**, a verifier should:

1. Check whether correct default value has been used
   (*in the transition period between the old to the new RED Annex V this will be a bit more complicated, as there will be a period in which some MS will have implemented the new Annex V while other MS have not done so yet*)
2. Check: Is it allowed to use a default value?
   (*Use decision tree from Communication on practical application…*)



Verification of actual calculations

The RED **methodology** has to be applied correctly

1. When using recognised schemes / tools, the correct implementation of the methodology is guaranteed
2. If calculations are made with non-recognized tools / other means (e.g. spreadsheets), the correct application of the methodology has to be checked
3. If tools (recognized or not) offer possibilities to implement changes, compliance with the RED methodology and schemes rules has to be checked (e.g. BioGrace)
4. In national schemes / tools, specific national regulations may be implemented
   ➔ e.g. saldation is allowed in German ENZO tool

Verification of actual calculations

How to deal with **definition gaps** in the RED methodology

1. Some are tackled in recognized schemes
    1. BioGrace: definition of “defined region” for grid electricity mixes (national mixes in BioGrace)
    2. BioGrace; ISCC: cut-off criteria for chemicals etc.
2. Some are not yet addressed:
    1. Definition of ‘degraded land’ for bonus
    2. Clear definition of co-product and waste (e.g. fatty acids, jatropha cake)

    ➔ Certification schemes should be asked how to proceed

Verification of actual calculations

All **data / numbers** have to be correct

1. Check whether input data used in the calculation is supported by evidence (documentation)
2. Check whether correct standard values have been used,
   - either as defined by the scheme, or
   - user defined standard values (incl. evidence/documentation).

   This includes checking the correct global warming potentials (1, 23, 296)
3. Check whether correct numbers for the reference process have been used
   (As defined in the RED)
4. Check whether the calculation is correct
   (no calculation errors leading to incorrect outcomes have been made)
5. Complementary calculations may be necessary for converting data into the right units

Discussion

- What are you experiences with verifying actual calculations?
- What difficulties do you face in verification?
- Where would you need more specific guidance?
- Which definition gaps are you faced with?
- Which sources of information do you use?

2. Exercise on a verification

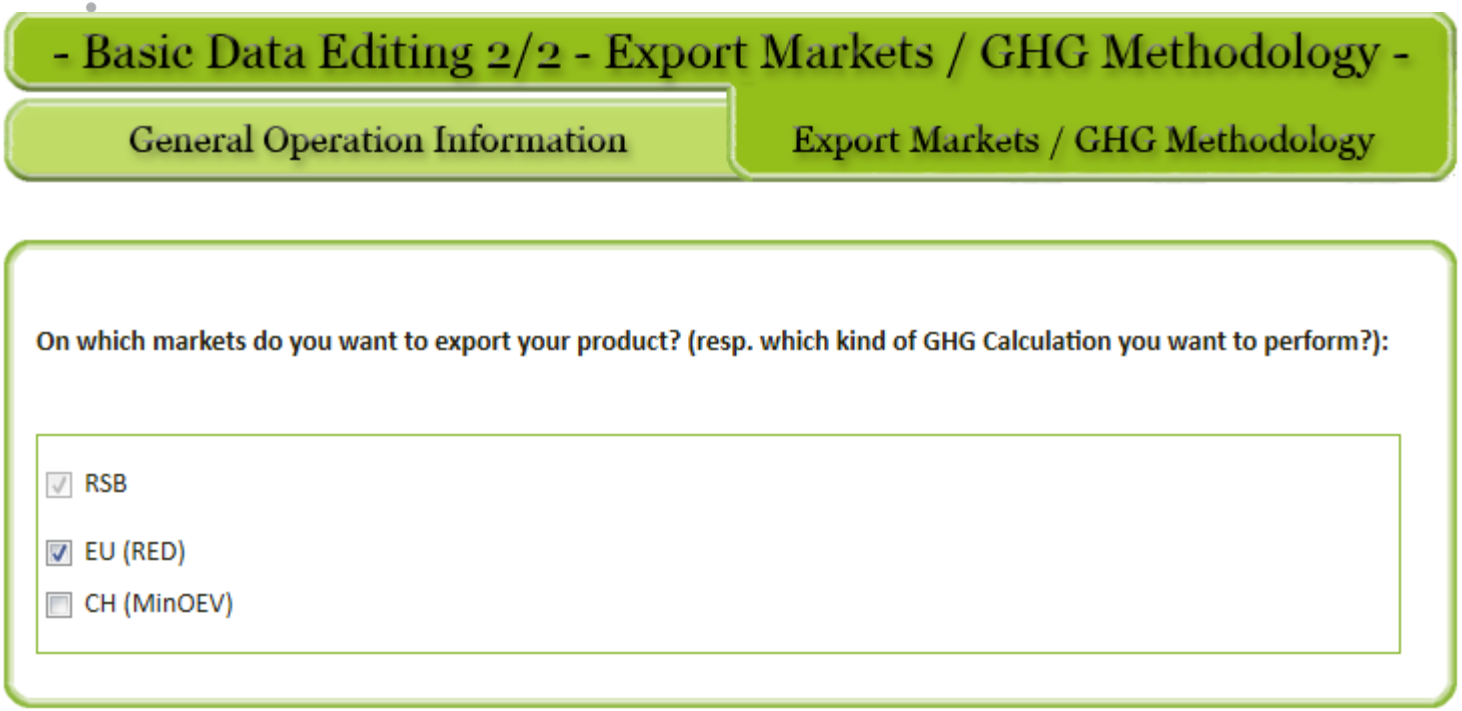
3. Other tools under the RED and the FQD

a) RSB GHG calculation tool

Introduction

- Developed by Roundtable on Sustainable Biofuels (RSB)
  - RSB Principle and Criteria for Sustainable Biofuel Production
  - RSB Standard for EU market access
- Standard for EU market access has been recognized by the Commission
- Tool has not been submitted for recognition
- Allows to calculate greenhouse gas emissions of biofuels following three different methods
  - RSB methodology
  - EU RED methodology
  - Swiss methodology (MinOEV)
- Displays default values of EU RED and LCFS

Introduction



Introduction

RED DEFAULT VALUES

Fuel: Biodiesel

Feedstock: Palm oil

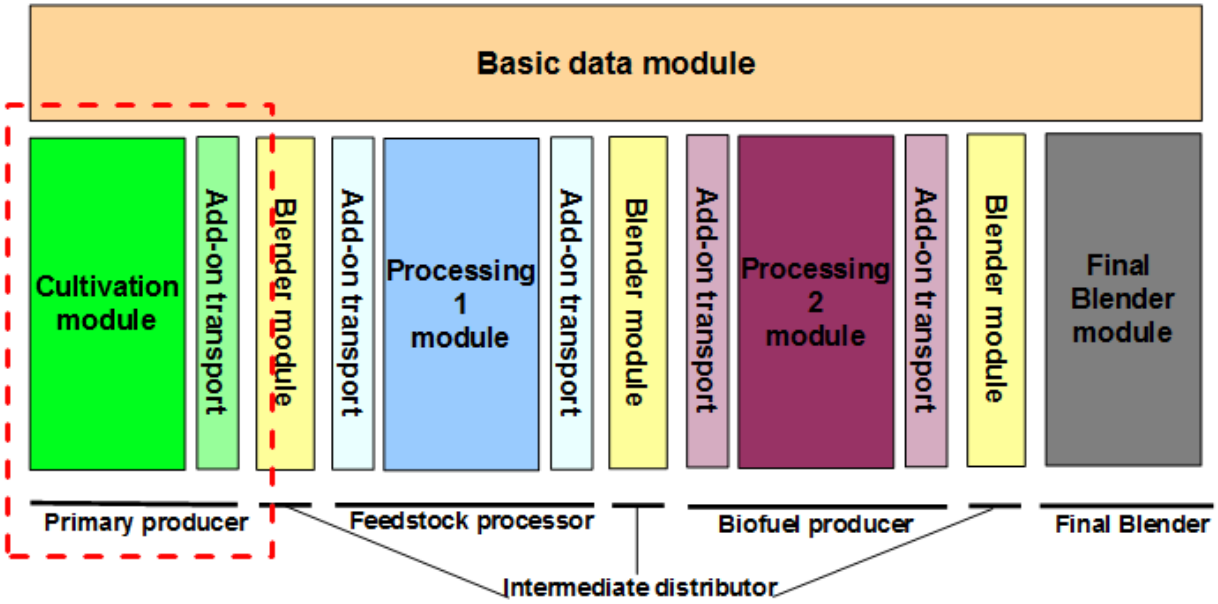
Process: process not specified

Search

	Value	Unit
Default GHG emission savings	**19**	**%**
Cultivation - disaggregated value	14	g CO_2eq/MJ
Processing - disaggregated value	49	g CO_2eq/MJ
Transport and distribution - disaggregated value	5	g CO_2eq/MJ
Total	68	g CO_2eq/MJ

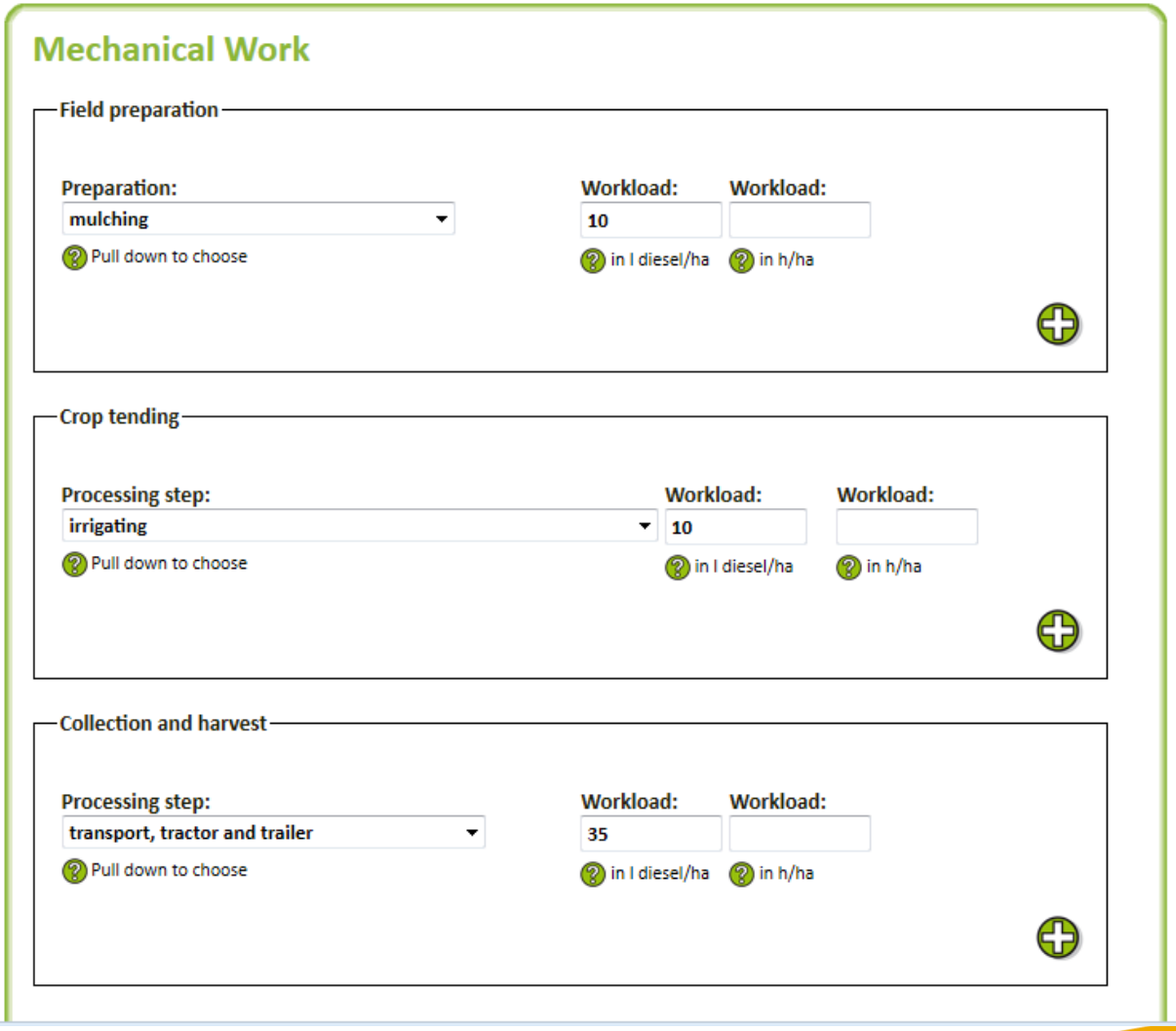
Principles

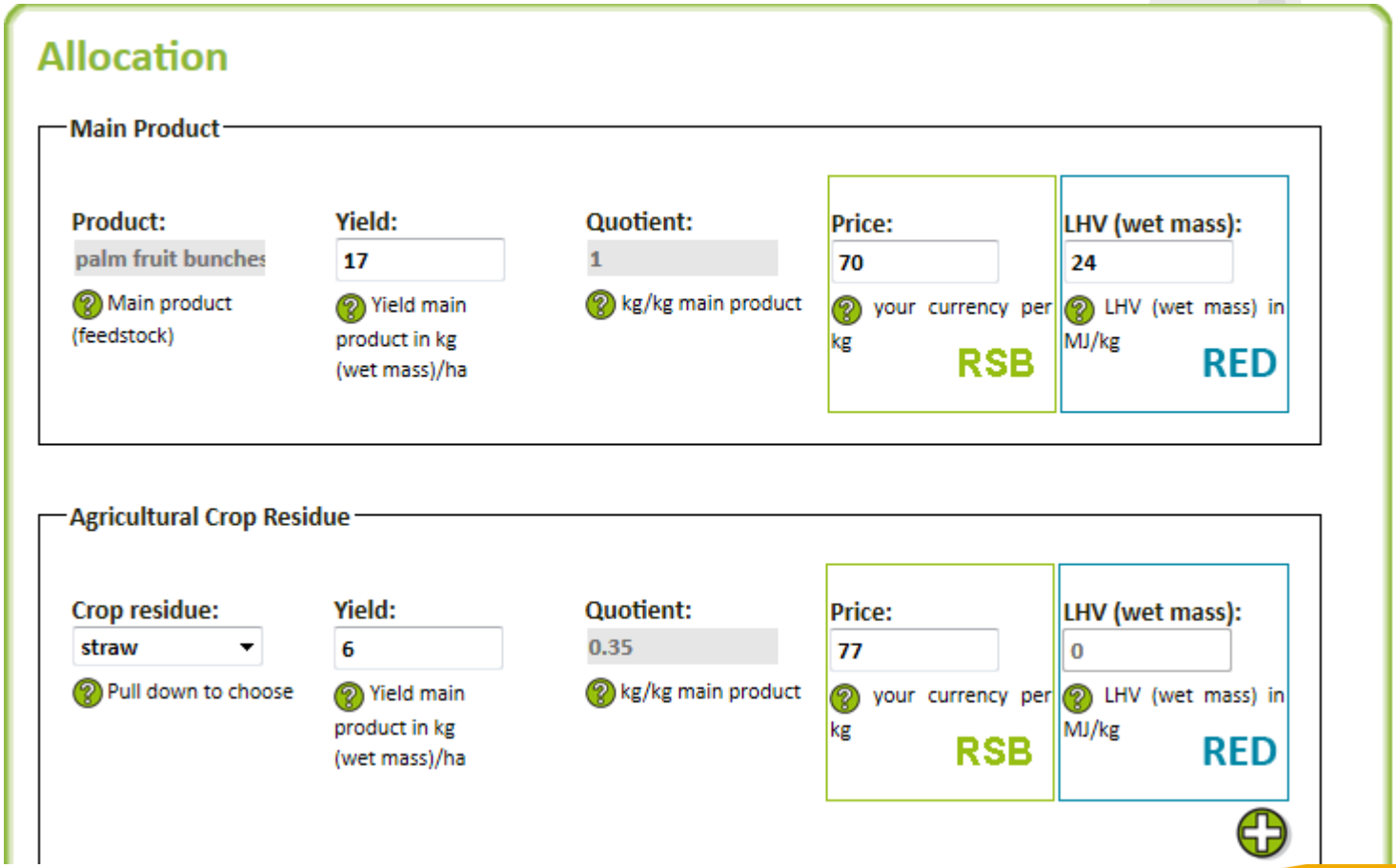
- Web-based (own account necessary, free of charge); modular approach
- General setup ➔ can be used for all types of biofuels



Principles

- Web-based (own account necessary, free of charge); modular approach
- General setup ➔ can be used for all types of biofuels
- Modifications allowed in the RED context:
  - Use of individual input numbers for doing actual calculations
  - Addition of an unlimited number of input values
  - Set up completely new production chains (beyond RED-pathways)
- Does not allow to change or use own standard values


Mechanical Work
Field preparation
Preparation:
mulching
Pull down to choose
Workload:
10
in l diesel/ha
Workload:
in h/ha
Crop tending
Processing step:
irrigating
Pull down to choose
Workload:
10
in l diesel/ha
Workload:
in h/ha
Collection and harvest
Processing step:
transport, tractor and trailer
Pull down to choose
Workload:
35
in l diesel/ha
Workload:
in h/ha


Allocation
Main Product
Product:
palm fruit bunches
Main product (feedstock)
Yield:
17
Yield main product in kg (wet mass)/ha
Quotient:
1
kg/kg main product
Price:
70
your currency per kg
RSB
LHV (wet mass):
24
LHV (wet mass) in MJ/kg
RED
Agricultural Crop Residue
Crop residue:
straw
Pull down to choose
Yield:
6
Yield main product in kg (wet mass)/ha
Quotient:
0.35
kg/kg main product
Price:
77
your currency per kg
RSB
LHV (wet mass):
0
LHV (wet mass) in MJ/kg
RED

Principles

- Web-based (own account necessary, free of charge); modular approach
- General setup ➔ can be used for all types of biofuels
- Modifications allowed in the RED context:
  - Use of individual input numbers for doing actual calculations
  - Addition of an unlimited number of input values
  - Set up completely new production chains (beyond RED-pathways)
- Does not allow to change or use own standard values
- For incoming products
  - upstream data based on own calculations or
  - data from product transfer documents are used.
  - If several feedstocks with different GHG intensities are used, the weighted average is calculated
- Functional units: g CO_2 / kg final product for each of the modules; g CO_2 / MJ fuel only in the final module (‘final transport and blending’)

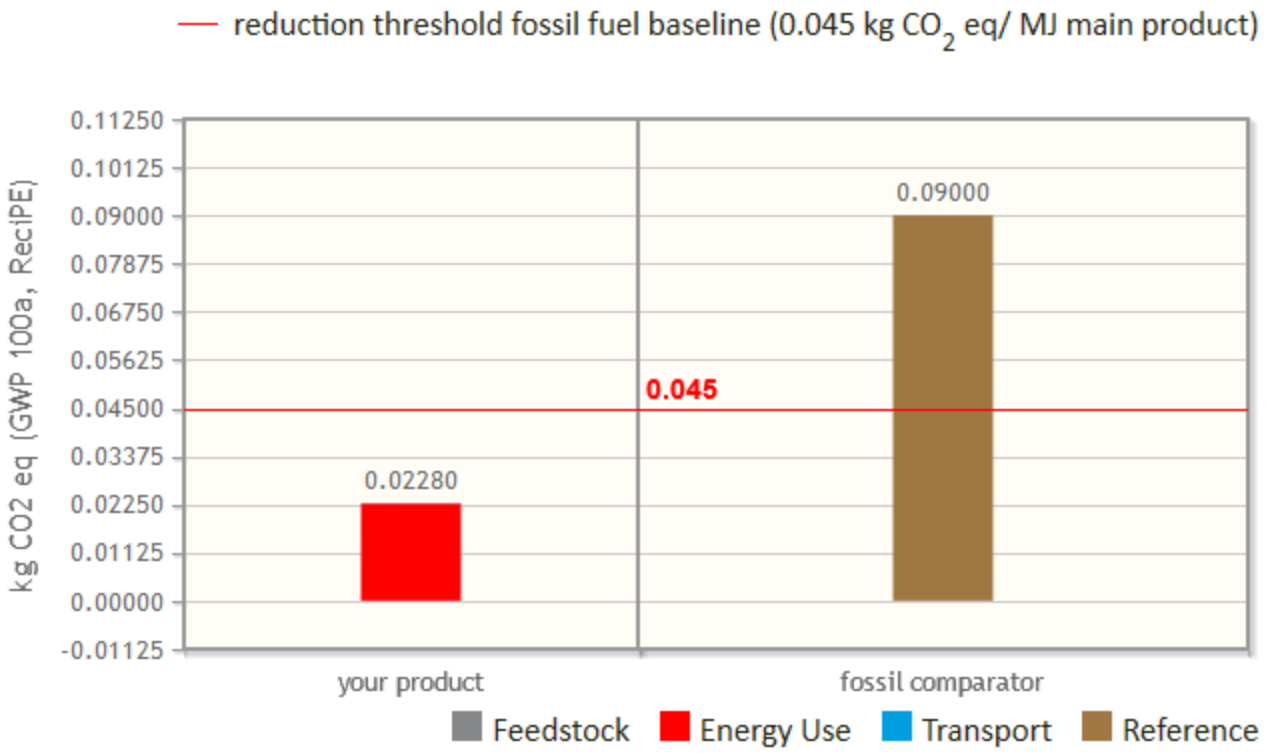
Feedstock Share

	RSB	RED
Share: 50 % of total	**GHG Intensity:** kg CO_2 equivalent per kg feedstock (wet mass)	**GHG Intensity:** 4 kg CO_2 equivalent per kg feedstock (wet mass)
Share: 50 % of total	**GHG Intensity:** kg CO_2 equivalent per kg feedstock (wet mass)	**GHG Intensity:** 6 kg CO_2 equivalent per kg feedstock (wet mass)

RSB | RED

Calculation Result RSB

0.022804 kg CO_2 eq/ MJ



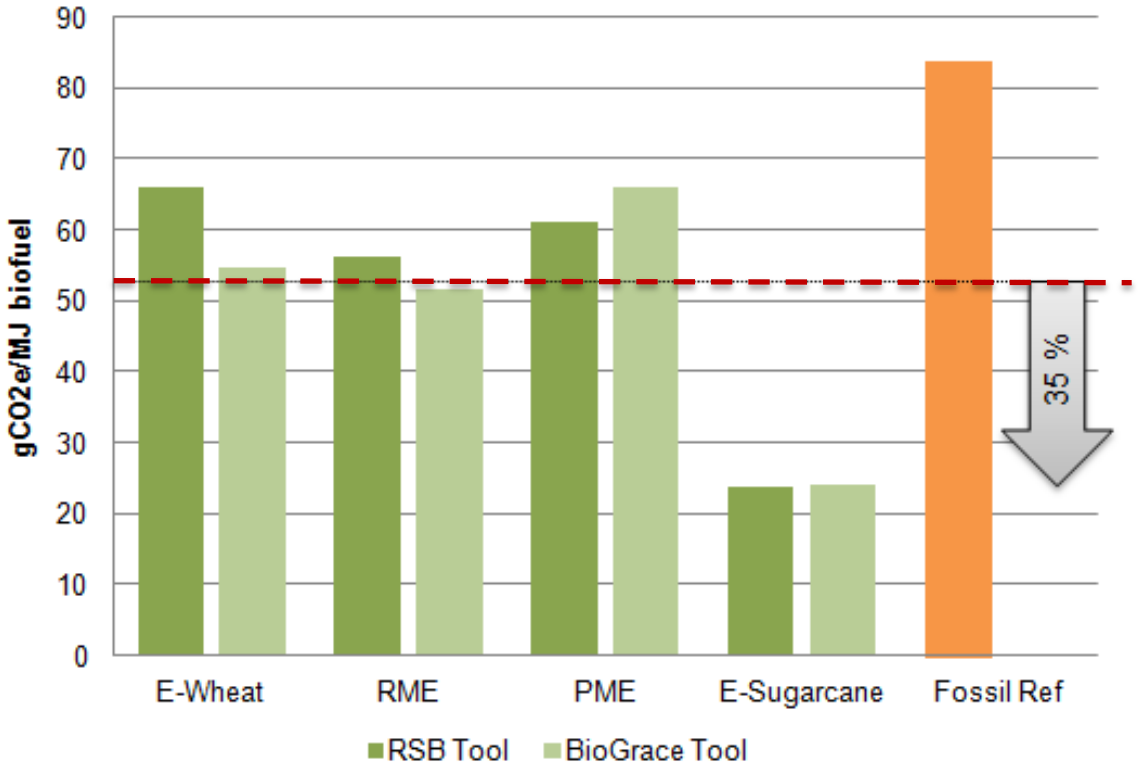
Comparison of BioGrace and RSB

BioGrace	RSB
Calculation sheet covers the whole pathway	**Modular calculation sheets** (cultivation, processing 1&2, Final blender)
Functional unit: Different units (input data to be filled **per MJ intermediate product;** emissions provided **per kg intermediate product)**	**Functional unit:** **kg product** of a process at specific actor level
No saldation	**Saldation possible**
List of standard values	**Background data from ecoinvent**
Objective: transparency of annex V values & actual calculations	**Objective: easy GHG calculation for non-expert users**

Comparison of BioGrace and RSB

- *Hennecke et al. (2012): Biofuel greenhouse gas calculations under the EU-RED – a comparison of the BioGrace tool versus the tool of the RSB*
- Objective: quantification of differences in the GHG results between the tools
- Calculation of four typical biofuel pathways in both tools
  - Ethanol from sugarcane
  - Ethanol from wheat
  - Biodiesel from rapeseed
  - Biodiesel from oil palm

Comparison of BioGrace and RSB



Reasons for deviation

- Deviations due to differences in
  - data base
  - methodology (definition gaps in the EU-RED)
  - handling of the tools by the user
- Greatest deviation in **cultivation** step due to
  - different calculation of N_2O field emissions (BioGrace: DNDC; RSB: IPCC 2006)
  - different emission factors for N-fertilizer
- Small deviation in **processing** due to different emission factors for chemicals and electricity
- Deviations in **land use change**:
  - RSB tool includes carbon stock in dead organic matter and emissions from land clearing by burning
  - In the RSB tool GHG savings from improved management are allocated between main and co-product (no clear specification in the EU-RED)
  - Different declaration of sugarcane (‚cropland' or ‚perennial tree/crop')

3. Other tools under the RED and the FQD

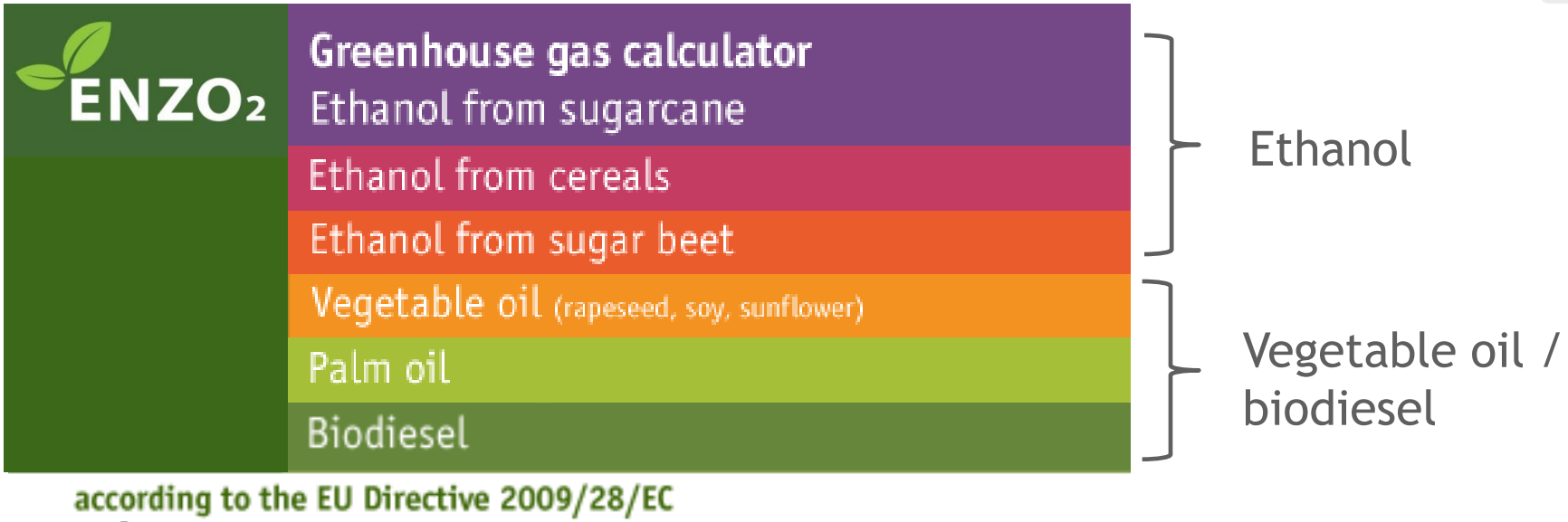
b) ENZO$_2$ (German calculator)

Introduction

- Developed by IFEU (financed by Ministry of Environment) for all biofuels / bioliquids that enter the German market
- Strictly follows RED methodology with specifications according to German legislation (e.g. saldation)
- Submitted for German recognition
- Harmonised with BioGrace tool
  - Same list of standard values ➔ same results in both tools
  - Constant updating (pathways, standard values, methodologies
- Contains all pathways for which RED-default values exist
- Shows calculation of default values as starting values; however, it is not allowed to use them

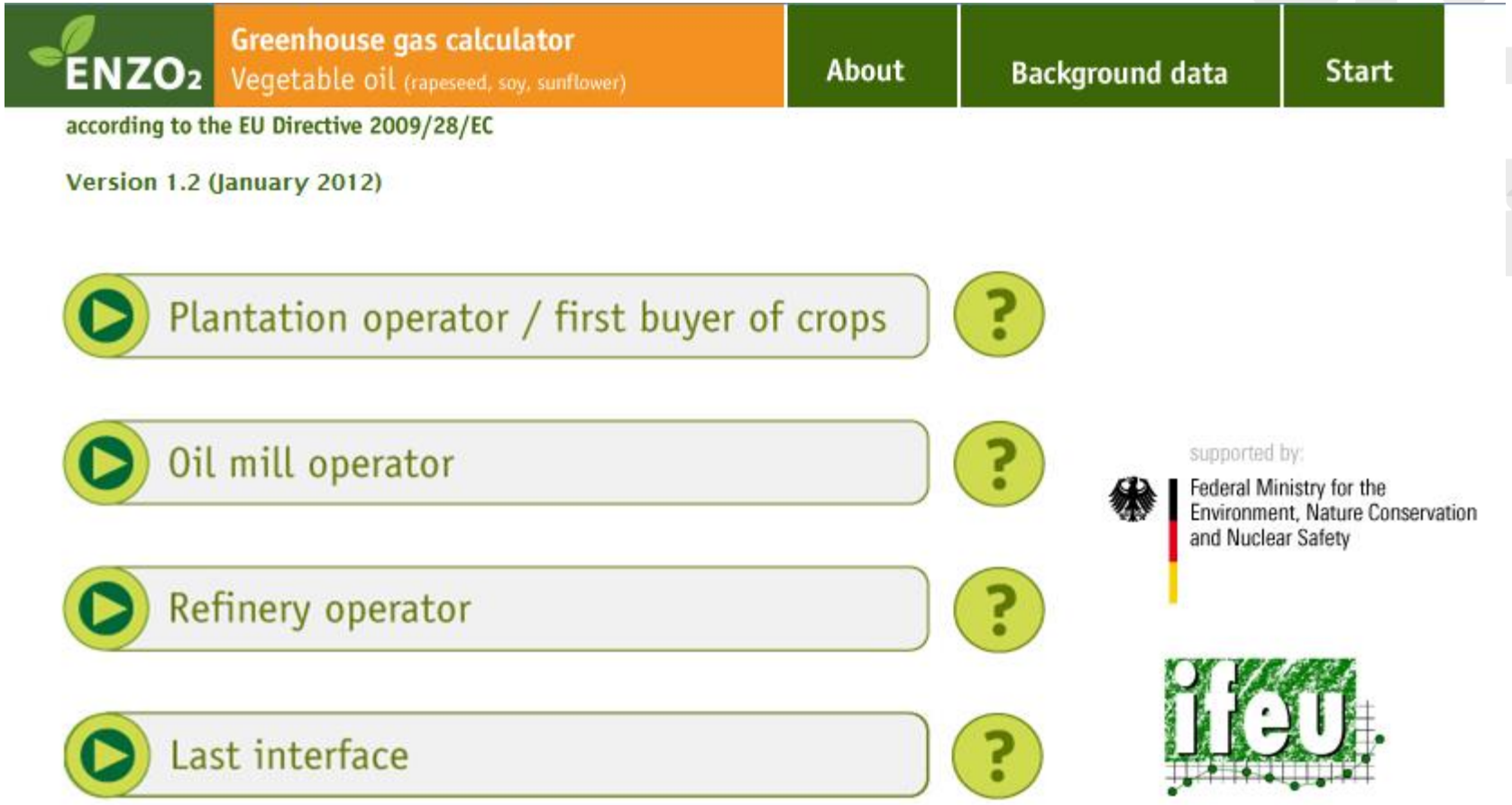
Principles

- Excel-based (will be available at www.ifeu.de)
- 6 separate tools for different feedstocks / pathways



Principles

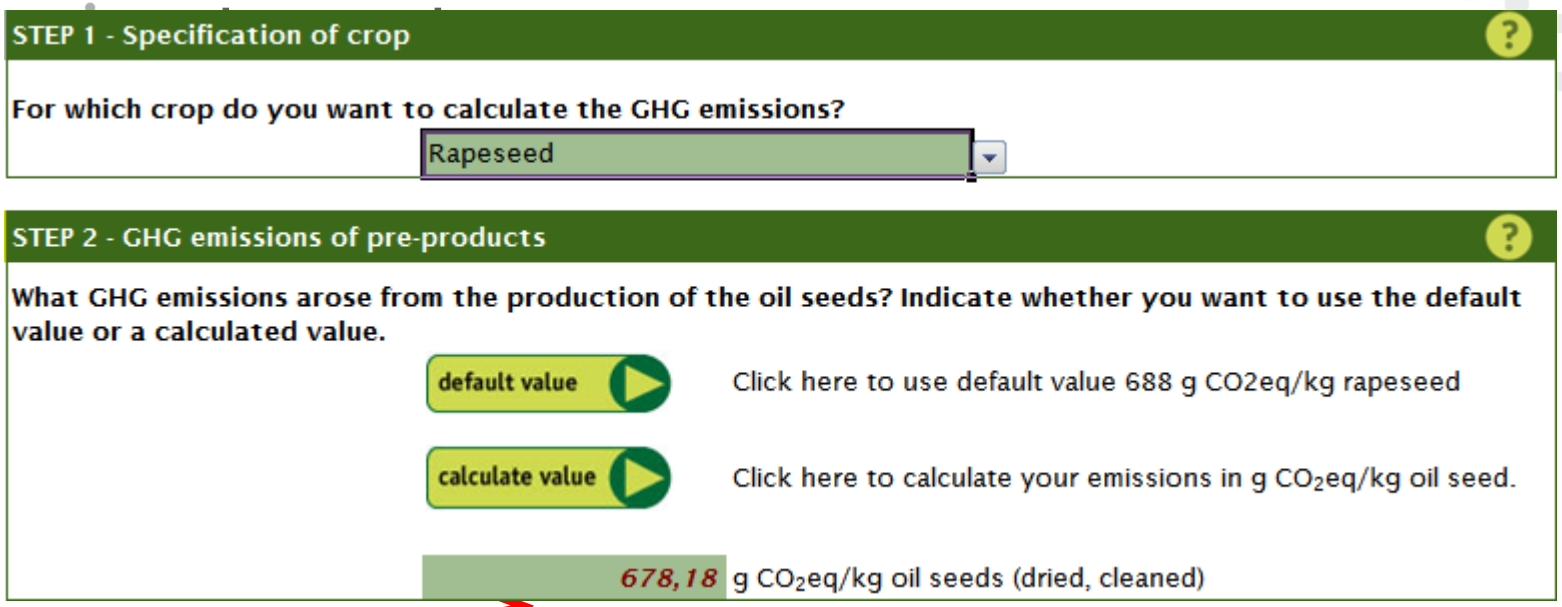
- Excel-based (will be available at www.ifeu.de)
- 6 separate tools for different feedstocks / pathways
- Modular approach
  - Each market actor can enter his specific data independently from upstream and downstream processes

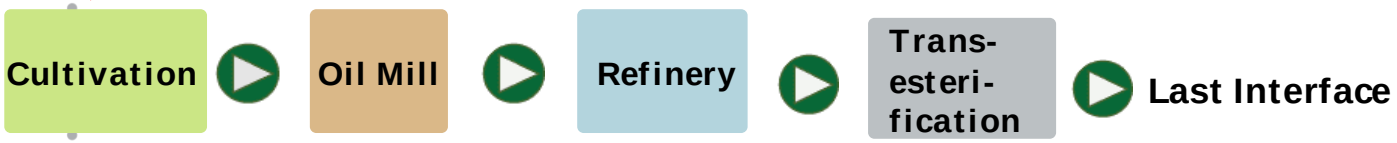

ENZO2
Greenhouse gas calculator
Vegetable oil (rapeseed, soy, sunflower)
About
Background data
Start
according to the EU Directive 2009/28/EC
Version 1.2 (January 2012)
Plantation operator / first buyer of crops
Oil mill operator
Refinery operator
Last interface
supported by:
Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
ifeu

Principles

- Excel-based (will be available at www.ifeu.de)
- 6 separate tools for different feedstocks / pathways
- Modular approach
  - Each market actor can enter his specific data independently from upstream and downstream processes
- Modifications allowed
  - Use of individual input numbers for actual calculations
- Does not allow to add or change pathways and standard values
- Pre-products
  - upstream data based on own calculations or
  - data from product transfer documents are used.
  - Saldation of incoming feedstocks is allowed (restrictions)
- Functional units: g CO_2 / kg final product for each of the modules; g CO_2 / MJ fuel only in the final module ('Last interface')

Emission of pre-products





STEP 4 - GHG emissions from oil mill operation		
How much energy did the oil mill consume per year?		
Diesel		l per year
Hard coal		kg per year
Heavy fuel oil (HFO)		l per year
Light fuel oil		l per year
Lignite		kg per year
Natural gas	*2.501.532*	kWh per year
Straw		kg per year
Wood chips from forest residues, domestic origin		kg per year
Electricity (external)	*520.146*	kWh per year
Electricity mix	*Electricity EU mix MV*	

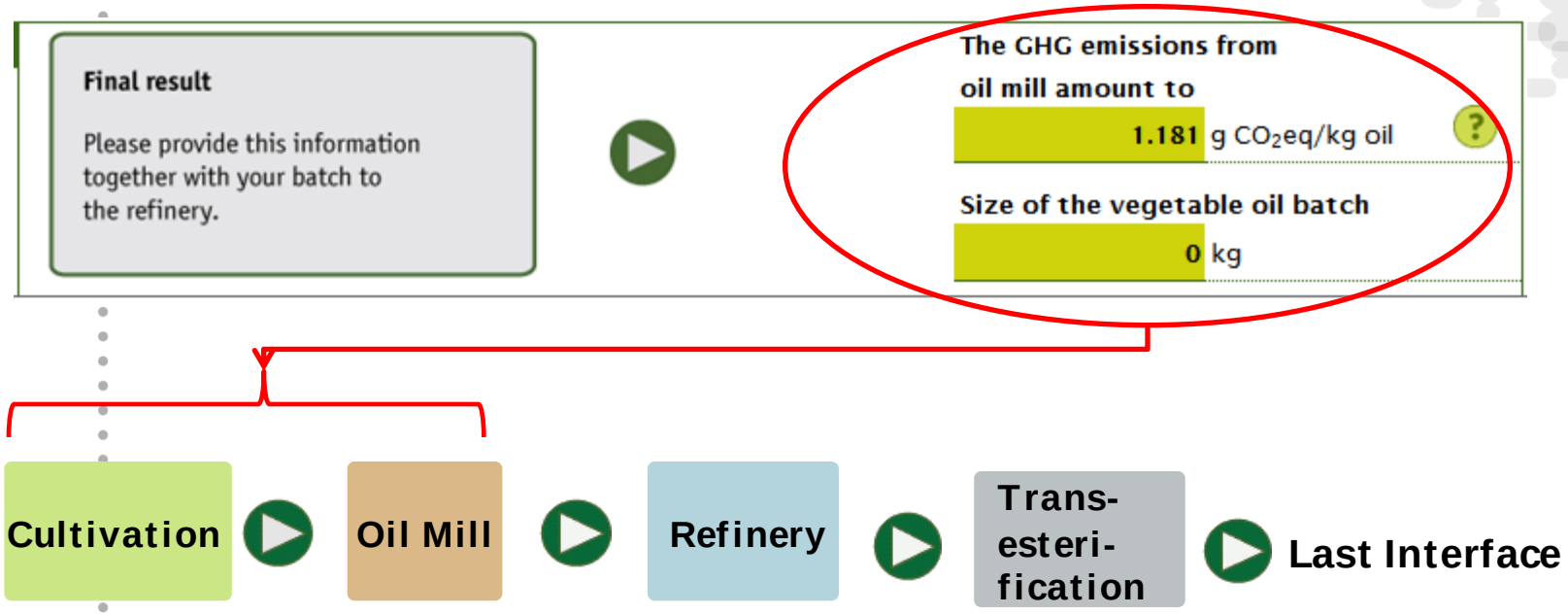
input X emission factor

BACKGROUND DATA parameter: unit:	GHG emission coefficient gCO_2/MJ	gCH_4/MJ	gN_2O/MJ	$gCO_{2\text{-eq}}/MJ$
Fuels- gasses				
Natural gas (4000 km, Russian NG quality)	61,58	0,1981	0,0002	66,20
Natural gas (4000 km, EU Mix qualilty)	62,96	0,1981	0,0002	67,59
Methane				

Automatic calculation of emissions

Calculation of emissions (automatic)		
Diesel	0,00 g CO_2eq per kg oil	
Hard coal	0,00 g CO_2eq per kg oil	
HFO	0,00 g CO_2eq per kg oil	
Light fuel oil	0,00 g CO_2eq per kg oil	
Lignite	0,00 g CO_2eq per kg oil	
CH4 and N2O emissions from Lig	0,00 g CO_2eq per kg oil	
Natural gas (4000 km, EU Mix qu	150,56 g CO_2eq per kg oil	
CH4 and N2O emissions from NG	0,79 g CO_2eq per kg oil	
Wheat straw	0,00 g CO_2eq per kg oil	
Wood chips from forest residues	0,00 g CO_2eq per kg oil	
Electricity EU mix MV	59,13 g CO_2eq per kg oil	
Electricity (Diesel)	0,00 g CO_2eq per kg oil	(surplus)
Electricity (Hard coal)	0,00 g CO_2eq per kg oil	(surplus)

Final result



Comparison of BioGrace and ENZO$_2$

BioGrace	ENZO2
Calculation sheet covers the whole pathway	**Calculation sheets seperately for each market actor** (e.g. cultivation, oil mill, biodiesel producer)
Functional unit: Different units (input data to be filled **per MJ intermediate product;** emissions provided **per kg intermediate product)**	**Functional unit:** **kg product** of a process at specific actor level
No saldation	**Saldation according to §16(2)2b**
Objective: transparency of annex V values & actual calculations	**Objective: easy GHG calculation for non-expert users**

Information for verification

- Possibilities for changing the calculator are restricted ➔ only input values and LUC-calculations have to be checked
- Important information and rules are displayed in the help buttons; mostly refer to BioGrace calculation rules (e.g. fertilizer types)
- Saldation:
  - German legislation allows the calculation of weighted average emissions for incoming feedstocks
  - However, saldation only allowed for those batches that do not exceed certain thresholds (thresholds are displayed in the respective sheets)

Saldation

Mixing sugar beet batches from several suppliers and averaging GHG emissions

Overall quantity metric tonnes	Overall GHG value g CO_2eq/kg beet
0	0

confirm value and back

Supplier#	Plantation name	Beet quantity metric tonnes	GHG value g CO_2eq/kg beet
1			
2			
3			
4			
5			
6			
7			

fill in the information delivered by your suppliers

4. Calculation example for ENZO$_2$

Thank you for your attention

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