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Greenhouse Gas Balances for the German Biofuels Quota Legislation

Methodological guidance and default values

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on behalf of Umweltbundesamt (UBA) Germany

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Introduction

→ In Germany: law of a **mandatory biofuel quota** (Biofuel quota act) effective since January 2007.

(following the EU Directive 2003/30/EG)

→ An R+D project on behalf of Federal Environment Agency (UBA) is started to work out a set of criteria for sustainable biomass production and use.
GOAL: to deliver input to the GBEP process (originally); now also: to deliver input according to the requirements of the Biofuel quota act.

→ Intensive discussion and exchange with similar activities in the Netherlands, UK other European states and the EU.

Introduction

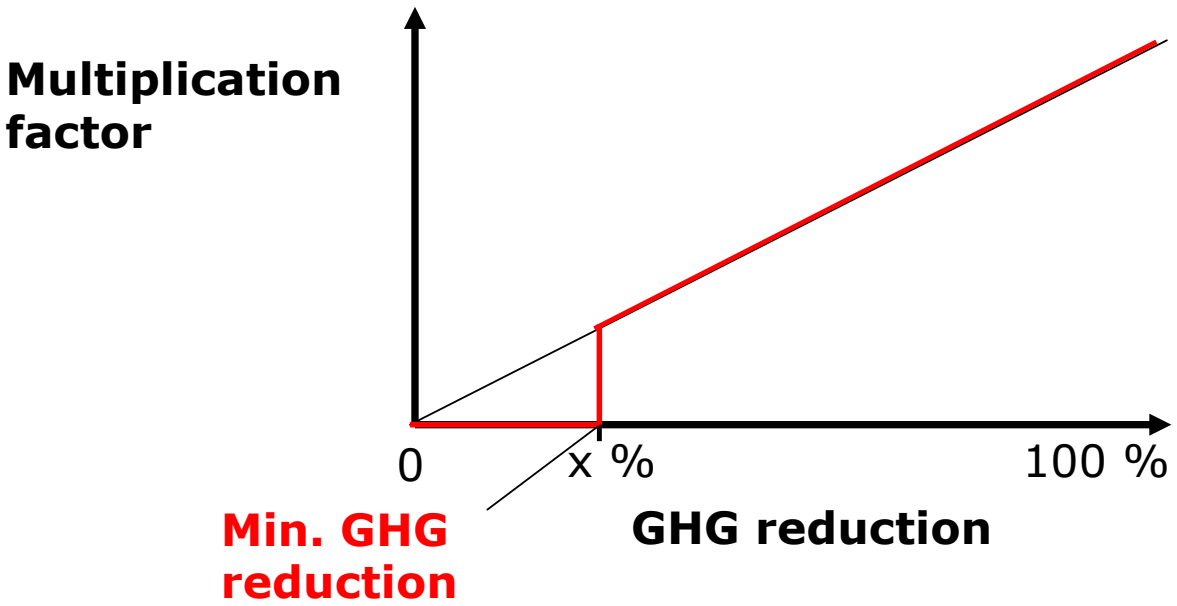
→ **Requirements Biofuel Quota Act:**

- the federal government is authorised to modify the actually acknowledged quota by regarding the real GHG savings. multiplication of the annually sold amount of a specific biofuel with a correction factor.
- a minimal level of CO_2 savings for the biofuels is required,
- sustainable cultivation of agricultural land.
- protection of natural habitats.

→ Authorization to concretize these requirements by an ordinance (first draft): Biofuel sustainability ordinance.

General principles of the “ GHG tool“

- Biofuel quota act authorises the government to introduce a **multiplication factor** for different biofuels **based on** their **GHG savings**.



R+D Project: Themes

The current state of proposed themes and principles to be addressed by a certification system for sustainable biomass.

1 There has to be a significant contribution to **greenhouse gas mitigation**!

2 **Land use** practices and land use changes driven by biomass production shall not lead to significant **ecological impacts**!

3 Increased biomass production shall not lead to worse **social-economic** situations!

R+D Project: Principles

The current state of proposed principles:

1	Significant contribution to greenhouse gas mitigation!
2	Effects from indirect land use changes (competition) have to be considered.
3	Loss of habitats of high conservation value shall be prevented
4	Loss of biodiversity shall be prevented (incl. criteria considering farmland biodiv. and GMO)
5	Negative impacts on soil. water and air shall be minimized
6	Local population shall not drawbacks but participate in opportunities
7	Ownership has to be respected
8	Respect internationally required social standards

General principles of the “ GHG tool“

- Considering all steps of the life cycle chain
- Setting default values
- Transparent calculation model with transparent co-product consideration

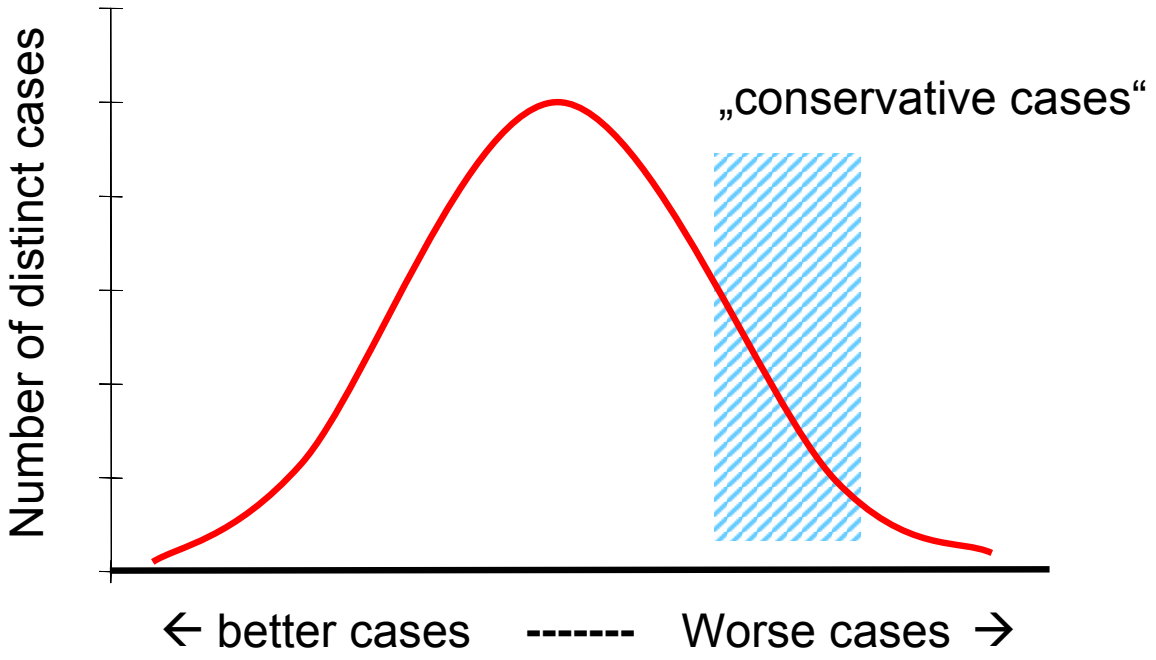
General principles of the “ GHG tool“

Default values:

- The emission of GHG shall be calculated in the unit “kg CO_2 equivalent / GJ of fuel”.
- A differentiation has to be made for using default values and using singular case values.
- The default values are based on conservative but realistic cases for Germany. They have to be applied if no certified singular case values are available.
- The default values are configured in a modular way according to the different steps of the biofuel production system.

General principles of the “ GHG tool“

Default values: definition of “conservative”



General principles of the " GHG tool"

Biofuel production steps	Considered in calculation
1. direct land use change (LUC)	carbon balance: (C storage in crop system minus C storage in previous system). time span **20 years**; avoided N_2O, CH_4 emissions from previous system; caused N_2O, CH_4 in case of burnings.
2. production of biomass	GHG emissions from fuel use. fertilizers and pesticide production; in case: energy for irrigation; N_2O, CH_4 emissions from crop system
3. transport of biomass	Depending on the system
4. conversion step I	GHG emissions from energy supply. fuel use. auxiliary materials.
5. transport between steps	Depending on the system (might be missing)
6. conversion step II	GHG emissions from energy supply. fuel use. auxiliary materials.
7. transport to fuel storage for admixture (refinery)	Depending on the system
8. Indirect land use change	*"risk adder" (currently in further elaboration)*

General principles of the “ GHG tool“

Considering co-products:

There are various options to consider co-products.

From all these the most appropriate are judged to be…

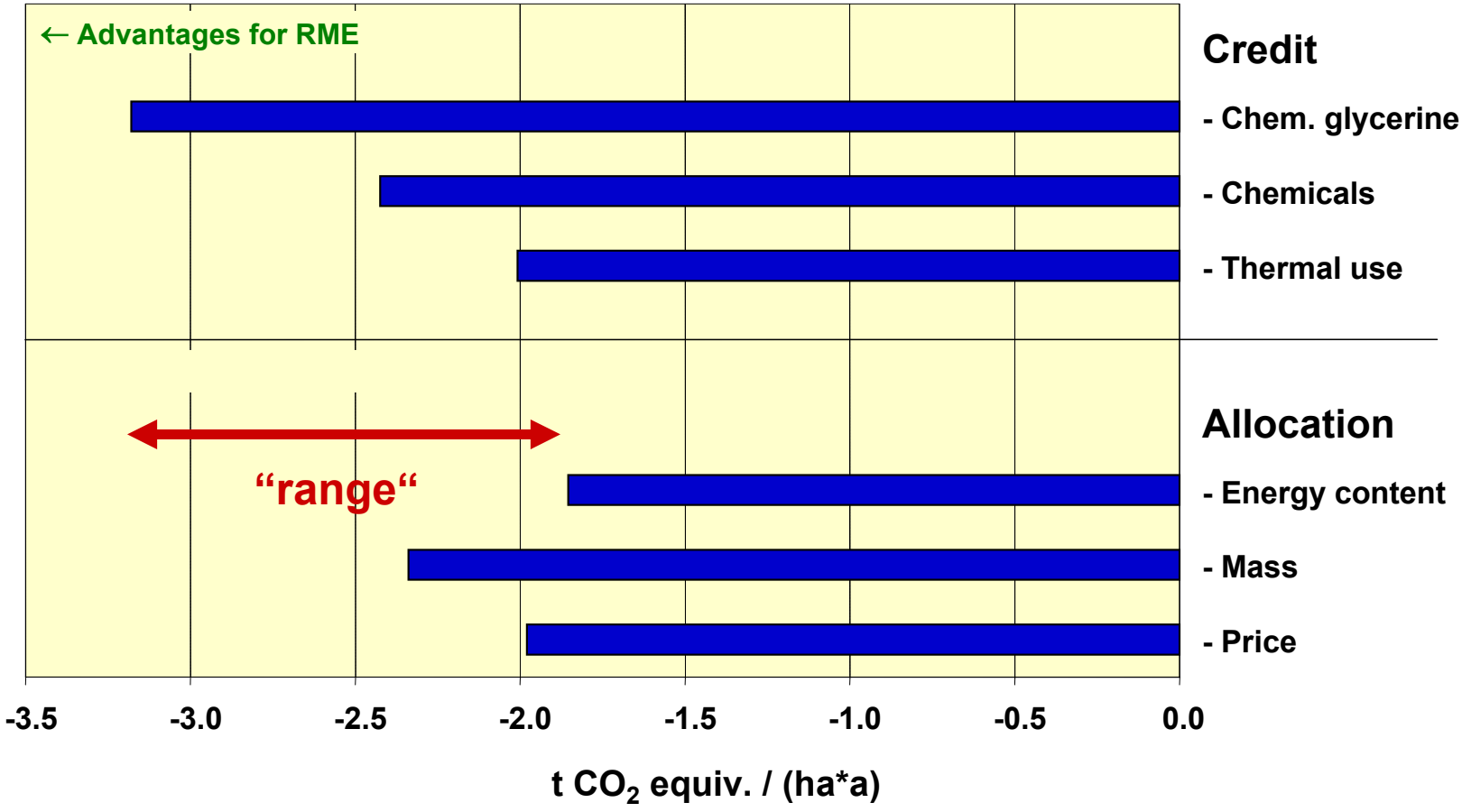
- Allocation based on **energy** figures (i.e. lower heat value)
- Allocation based on **market** values (prices)
- Delivering **credits** for substitution of other products

Each option shows specific advantages and disadvantages.

One important requirement is: minimize arbitrariness!

General principles of the “ GHG tool“

Considering co-products: e.g. RME vs. Diesel



General principles of the “ GHG tool“

Allocation of co-products:

- All inputs and outputs shall be attributed to the co-products by their share of the lower heat value.
- This is to minimize the arbitrariness for the objective of the Biofuel Quota Law because it provides a clear and measurable figure to be used as a rule for allocation.
- An energy figure is appropriate for allocation in this context because the Biofuel Quota Law is about the substitution of fossil energy.
- Biomass which stays on the land or is returned to it (directly or indirectly) is not treated as co-product but modelled in a closed loop. (→ Cross compliance)

Basics of the " GHG tool"

List of lower heat values (LHV):

		lower heating value				lower heating value	
agricultural products		MJ/kg d.m.	MJ/kg o.s.	**intermediate products**		MJ/kg d.m.	MJ/kg o.s.
Wheat	whole plant	17,1	13,5	Dried Distiller's Grains w. Solubles (DDGS)		21,8	16,0
	grains	17,0	13,7	Sugar juice (45% saccharose)		19,0	7,0
	straw	17,2	13,3	Bagasse (50% dm)		16,6	9,4
Maize (Corn)	whole plant	16,5	14,3	Melasse		16,0	16,0
	grains	21,4	17,4	rape seed oil		37,2	-
	straw	17,7	13,7	soy bean oil		36,6	-
Sugar cane	whole plant	17,0	11,0	palm oil		36,5	-
	cane	17,0	11,0	extraction cake from rape seed		19,0	15,0
Rape	whole plant	21,8	17,0	extraction cake from soy bean		19,0	15,0
	grains	26,5	21,8	fibrous cake from oil fruits		17,5	14,0
	herbaceous residuals	17,0	14,7	palm kernels		28,0	28,0
Soy bean	whole plant	18,0	14,5	**final products**			
	grains	20,0	17,0	Ethanol		26,7	-
	herbaceous residuals	17,0	13,0	RME		37,2	-
oil palm	full fruit bunch	24,6	22,3	SME		37,0	-
	fruits	31,7	31,5	PME		36,6	-
	empty fruit bench	17,5	14,0	Glycerine (20% w after transesterif.)		17,0	13,4

Calculation example RME

Direct / *(indirect)* land use	Biomass production	Transport of biomass	Conversion step 1	Transp. betw. Conv. steps	Conversion step 2	Transport to refinery	
Grassland 200 m²	Rapeseed cultivation	100 km Lorry	Oil mill	100 km Truck	Transesteri-fication	150 km Truck	1 GJ RME
	68 kg Rape straw	68 kg Rapeseed	40,83 kg RES	27,15 kg Rapeseed oil	2.53 kg Glycerine	26.88 kg RME	
54.9	**48.8**	**0.7**	**12.1**	**0.21**	**8.2**	**0.3**	**kg CO_2-Eq.**
62,3% x 96%	62,3% x 96%	62,3% x 96%	62,3% x 96%	96%	96%	100%	Allocation factor
31.8	**29.1**	**0.4**	**7.6**	**0.2**	**7.6**	**0,3**	**kg CO_2-Eq.**
						78,1	**kg CO_2-Eq.**

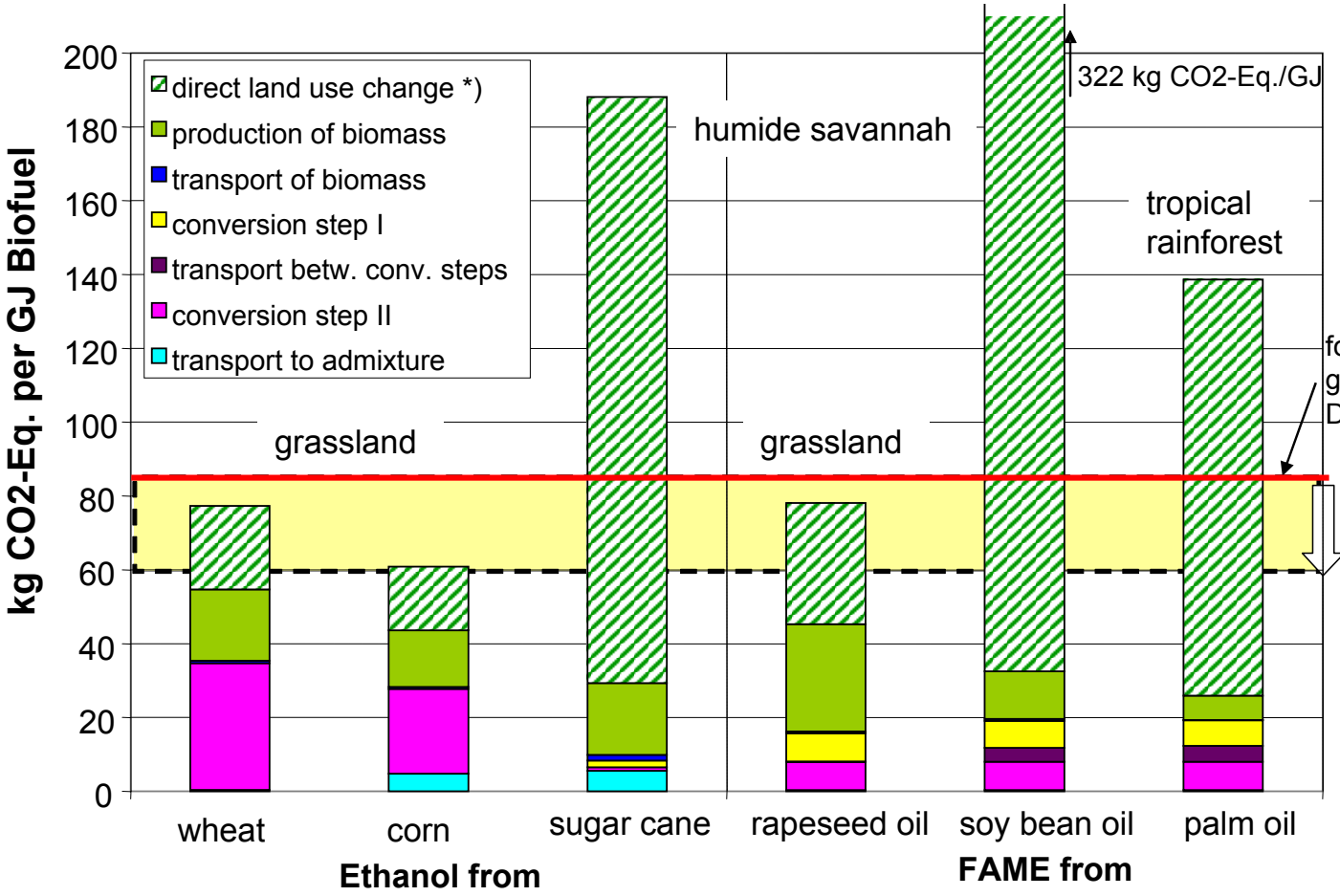
Exemplary calculations

exemplary values based on an allocation (LHV) :

in kg CO_2-eq./GJ	Ethanol from wheat (EU)	Ethanol from corn (NAm)	Ethanol from sugar cane (SAm)	Methylester from rapeseed oil (EU)	Methylester from soy bean oil (SAm)	Methylester from palm oil (SEAs)
Land use change	22.7	17.2	158.8	32.8	289.5	112.8
Production of biomass	19.3	15.3	19.5	29.1	12.9	6.6
Transport of biomass	0.6	0.6	1.5	0.4	0.5	0.1
Conversion step I	-	-	1.7	7.6	7.3	6.9
Transport betw. steps	-	-	-	0.2	3.8	4.3
Conversion step II	34.3	23.0	1.0	7.6	7.7	7.7
Transport to refinery	0.4	4.8	5.5	0.3	0.3	0.3
indirect land use change	*Not yet implemented*					
Total	**77.3**	**60.8**	**188.1**	**78.1**	**321.9**	**138.7**
Total w/o LUC	**54.6**	**43.6**	**29.3**	**45.3**	**32.4**	**25.9**

Calculation examples

exemplary values based on an allocation (LHV) :



***) direct land use change:** values correspond to bad and non-sustainable cases; default values have to be in line with sustainability per definition.

fossil reference systems
gasoline: 85 kg/GJ.
Diesel: 86.2 kg/GJ

Sum-up

- → Germany will establish a GHG methodology according to the Biofuel sustainability ordinance.
- → The whole life chain – including direct and indirect land use change – is considered.
- → Default values are set is case of missing specific data of producer.
- → A harmonization within the EU is strongly supported.