THE GOVERNMENT

OF THE GRAND DUCHY OF LUXEMBOURG

Ministry of Economic Affairs and Foreign Trade

Determination of disaggregated default values for the reporting obligation laid down in Article 19(2) under the Directive on the promotion of the use of energy from renewable sources (2009/28/EC) and in Article 7d(2) under the Directive as regards the specification of petrol, diesel and gas-oil and introducing a mechanism to monitor and reduce greenhouse gas emissions (2009/30/EC) for Luxembourg

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1 Background

Under the Renewable Energy Directive (2009/28/EC), the use of biofuels and bioliquids in Article 17(2) must achieve a greenhouse gas emission saving of at least 35 % (from 2017 50 % +) under the terms of sustainability criteria in order to be recognised for national support and quota schemes.

In order to prove that this saving has been made, Article 19(1) allows in principle for the application of the default values listed in Annex V of the Directive. However, the applicability of these default values is subject to conditions which are set out in Article 19(2).

The same wording of the conditions is also used in Article 7d(2) of the Fuel Quality Directive (2009/30/EC):

For raw materials cultivated in the Community in areas, these default values shall apply only if the areas *'are included in the lists referred to in paragraph 2*'. Paragraph 2 stipulates that *'… by 31 March 2010, Member States shall submit to the Commission a report, including a list of those areas on their territory classified as level 2 in the "nomenclature of territorial units for statistics (NUTS)" or as a more disaggregated NUTS level … and where the typical greenhouse gas emissions from cultivation of agricultural raw materials can be expected to be lower than or equal to the emissions reported under the heading "Disaggregated default values for cultivation" in Part D of Annex V [sic]* to this Directive, accompanied by a description of the method and data used to establish that list. That method shall take into account soil characteristics, climate and expected raw material yields.'*

Until such a report has been submitted to the Commission, the Member States cannot use the default values specified in Annex V of the Directive for domestic raw materials.

Against this background, the Ministry of Economic Affairs and Foreign Trade of the Grand Duchy of Luxembourg instructed the IFEU to set the 'disaggregated default values for cultivation' of relevance to Luxembourg in accordance with Part D of Annex V [sic].

2 Objective, framework and approach

The objective is the submission of scientifically robust default values for the cultivation of raw materials of relevance to Luxembourg for producing bioenergy resources in order to allow the basis, as required under Article 17(2), of the applicability of the disaggregated default values (Part D of Annex V [sic]) for producers in Luxembourg.

The framework of the biomass raw materials of relevance to cultivation in Luxembourg comprises:

- wheat
- rape

The following approach is adopted:

1. The basis on which the default values in Part D of Annex V [sic] were calculated for 'e_{ec}' (cultivation) is analysed and made transparent. This is based on the following sources:

- JRC1: 'JRC (2008) Update on Data on pathways for RES Directive.XLS' semi-public file, spreadsheet file sent by the Commission in November 2008 to various interested parties

- JRC2: „Input_data_BIO 181108.XLS" downloadable from: http://ies.jrc.ec.europa.eu/our-activities/support-to-eu-policies/well-to-wheels-analysis/WTW.html

- JRC/Eucar/Concawe (2008): WELL-TO-TANK Report Version 3.0 November 2008 - detailed descriptions downloadable from: http://ies.jrc.ec.europa.eu/uploads/media/WTT%20App%202%20v30%20181108.pdf

- first results of the Intelligent Energy Europe-backed BioGrace project ('Align biofuel GHG emission calculations in Europe'): website: http://www.BioGrace.net (available soon)

2. For the relevant input parameters, the data associated with Luxembourg are being compiled for the two products. The SER (Service d'Economie Rurale Luxemburg) supplied the data required for this purpose.

3. For the Luxembourg region, which is uniform at NUTS level 2, the greenhouse gas balance is being calculated for the above-mentioned crops and compared with the 'e_{ec}' default values of Part D of Annex V [sic].

3 Data basis

The basic data for the products of the agricultural raw materials in question are summarised in Tables 1 and 2. The data include

- from SER: area-based yields for Luxembourg;

- the specific amounts of fertiliser consumed (N, P, K). These are calculated based on the nutrient requirements of the plants after extraction. Extraction is derived from the nutrient contents of the harvest products. These are documented in the German Fertiliser Ordinance (*Düngeverordnung*, DüV) and elsewhere and were used in the same order of magnitude by the JRC for calculating the default values; The yield-based factors are for:

- wheat: 21.1 kg of N, 8 kg of P_2O_5 and 6 kg of K_2O per tonne of grain

- rape: 33.5 kg of N, 18 kg of P_2O_5 and 10 kg of K_2O per tonne of rape seed
- and also from KTBL[1]: values for typical amounts of diesel consumed which are calculated as follows: For each operation, the amount of diesel required is calculated as a function of the particular engine load in the individual operating phases (time periods). Key factors:

- size of plot and farm-to-field distance

- degree of mechanisation (engine capacity, working width, etc.)

- tillage resistance

[1] KTBL (Kuratorium für Technik und Bauwesen in der Landwirtschaft e.V.): computer for calculating diesel requirements; see http://www.ktbl.de/index.php?id=808

- throughput (harvest or application rate)
- rates of operation and transportation

It is assumed that conditions in Luxembourg are likely to be similar to those in Germany. There is therefore an area-specific consumption of diesel during cultivation of:

- wheat of 65 litres per hectare and annum (= 54.4 kg/(ha*a))
- rape of 84 litres per hectare and annum (= 70.3 kg/(ha*a))
- from the JRC files: all the information in the 'default values' columns, as well as the water contents, N_2O emissions, drying costs.

Emissions of nitrous oxide (N_2O)

The emissions of nitrous oxide (N_2O) were calculated as follows: The specific N_2O emission factor, based on the particular amount of N fertiliser, was derived from JRC1 for each product. These 'product-specific' factors were applied to the particular doses of N fertiliser for each crop and NUTS 2 region. This goes some way towards alignment with the JRC method, although certain geographically relevant factors may be disregarded. The N_2O factors derived from JRC 1 range from 0.01 to 0.0175 kg of N_2O-N/kg of N fertiliser. At 1 to 1.75 %, the emission factor is thus close to the default IPCC target (1 %).

Emissions in the production and use of diesel, fertiliser, pesticides

More basic data are needed in order to calculate greenhouse gas emissions from the amounts of diesel, fertiliser and electricity consumed. The necessary data are set out in Table 3. JRC1 and JRC2 do not contain any information on emission factors for essential inputs (in particular fertilisers). The emission factors are therefore inferred from the Well-to-Wheels Study (JEC 2007) on the assumption that, since the authors are the same, these values were also used for determining the default values.

Table 1 Basic data for the production of wheat

	Unit	Wheat LUX	JRC default value[d)]
Yield, fresh	t/(ha*a)	6.247[a)]	5.2
Water content, fresh	%	13.5 %[c)]	13.5%
Yield, dried	t/(ha*a)	5.57[c)]	4.64
Water content after drying	%	3 %[c)]	3 %
Field emissions	kg of N_2O/(ha*a)	2.18[c)]	1.81
Amount of diesel consumed	kg/(ha*a)	54.4[c)]	81.7
Amount of fertiliser consumed			

Nitrogen	kg of N/(ha*a)	131.8[b)]	109.3
Phosphorus	kg of P_2O_5/(ha*a)	50.0[b)]	21.6
Potash	kg of K_2O/(ha*a)	37.5[b)]	16.4
Lime	kg of CaO/(ha*a)	-	-
PSM	kg/(ha*a)	2.3[c)]	2.3
Drying			
Electricity	kWh/kg of grains	0.01[c)]	0.00832
Heavy fuel oil	MJ/kg of grains		

Source: a) SER data, b) extraction of nutrients corresponding to SER yield data, c) JRC data applied to SER yield data, d) JRC

Table 2 Basic data for the production of rape

	Unit	Rape LUX	JRC default value[d)]
Yield, fresh	t/(ha*a)	3.497[•)e)]	3.11[e)]
Water content, fresh	%	10 %[c)e)]	10 %[e)]
Field emissions	kg of N_2O/(ha*a)	2.64[c)]	3.1
Amount of diesel consumed	kg/(ha*a)	70[c)]	65
Amount of fertiliser consumed			
Nitrogen	kg of N/(ha*a)	117[b)]	137
Phosphorus	kg of P_2O_5/(ha*a)	63[b)]	34
Potash	kg of K_2O/(ha*a)	35[b)]	49
Lime	kg of CaO/(ha*a)	19[c)]	19
PSM	kg/(ha*a)	1.2[c)]	1,2
Drying			
Electricity	kWh/kg of seed	0.025[c)]	0.023
Heavy fuel oil	MJ/kg of seed	0.0048[c)]	0.0048

Source: a) SER data, b) extraction of nutrients corresponding to SER yield data, c) JRC data applied to SER yield data, d) JRC; e) In the case of rape, in contrast to wheat, the JRC calculations relate to the undried fresh mass of the harvest

Table 3 Greenhouse emission data for the production and use of diesel, fertiliser and electricity

	Unit	Value	Source
Diesel, heavy fuel oil EL	g of CO_2 eq./kg	3757	JEC (2007)
Electricity (EU)	g of CO_2 eq./kWh	465	JRC (2008)
Fertiliser			
Nitrogen	g of CO_2 eq./kg of N	5917	BioGrace project stand[a)]
Phosphorus	g of CO_2 eq./kg of P_2O_5	1018	JEC (2007)
Potash	g of CO_2 eq./kg of K2O	584	JEC (2007)
Lime	g of CO_2 eq./kg of CaO	124	JEC (2007)
PSM	g of CO_2 eq./kg	17258	JEC (2007)

a) Further to consultation of Ludwig-Bölkow-Systemtechnik (LBSt), the organisation which had calculated the default values for Annex V, by the BioGrace project group, the value cited here is the basic value of the calculation of the default values.

4 Results

The results are set out in Tables 4 and 5. It should be noted that the greenhouse gas emissions relate to the cultivated product (wheat, rape seed). However, the default value of the Directive is based on the MJ of the biofuel which is obtained only after further conversion processes. In addition, the default value of the Directive has already been allocated throughout the process chain, i.e. some of the emissions produced during cultivation were allocated to by-products formed in subsequent process steps. In order to make the value for greenhouse gas emissions for wheat and rape produced in Luxembourg comparable with the default value of the Directive, it is necessary in a further step to convert the values presented in 'kg of CO_2 eq./t of agricultural product' into 'g of CO_2 eq./MJ of biofuel'. The conversion rates and allocation factors, which may be inferred from JRC1, are included in this (Fehrenbach, Hennecke 2010). It should be noted that the reference made in Table 5 to oil from rape seed can be applied with identical results to rape seed oil biodiesel. The allocation of glycerol would slightly reduce the same-relation value as calculated for Luxembourg because the default part value for biodiesel is somewhat lower than vegetable oil.

Table 4 Greenhouse gas emissions calculated for the production of wheat

Wheat	Unit	Wheat LUX
Emissions based on 1 tonne of cultivated product		

Field emission (N_2O)	kg of CO_2 eq./t	115.7
Diesel used	kg of CO_2 eq./t	36.7
N fertiliser	kg of CO_2 eq./t	140.0
P fertiliser	kg of CO_2 eq./t	9.1
K fertiliser	kg of CO_2 eq./t	3.9
Ca fertiliser	kg of CO_2 eq./t	-
PSM	kg of CO_2 eq./t	7.1
Drying (electricity)	kg of CO_2 eq./t	0
Drying (diesel)	kg of CO_2 eq./t	7.1
TOTAL	kg of CO_2 eq./t	320
Total based on end product (biofuel)		
without allocation[a)]	g of CO_2 eq./MJ	36.1
with allocation[b)]	g of CO_2 eq./MJ	21.5
Default value e_{ec}	g of CO_2 eq./MJ	23
	kg of CO_2 eq./t	342[a)]

a)Recalculation based on the rate of conversion of kg of cultivated product/MJ of ethanol

b) with allocation of the DDGS by-product

Table 5 Greenhouse gas emissions calculated for the production of rape

Rape	Unit	Rape, Luxembourg
Emissions based on 1 tonne of cultivated product		
Field emission (N_2O)	kg of CO_2 eq./t	223.9
Diesel used	kg of CO_2 eq./t	75.6
N fertiliser	kg of CO_2 eq./t	198.2
P fertiliser	kg of CO_2 eq./t	18.3
K fertiliser	kg of CO_2 eq./t	5.8
Ca fertiliser	kg of CO_2 eq./t	0.7
PSM	kg of CO_2 eq./t	6.07
Drying (electricity)	kg of CO_2 eq./t	16.0

Drying (diesel)	kg of CO_2 eq./t	0.6
TOTAL	kg of CO_2 eq./t	545
Total based on end product (biofuel)		
without allocation[a)]	g of CO_2 eq./MJ	37.4
with allocation[b)]	g of CO_2 eq./MJ	23.6
Default value e_{ec}	g of CO_2 eq./MJ	30
	kg of CO_2 eq./t	694[a)]

Recalculation based on the rate of conversion of kg of cultivated product/MJ of oil from rape seed

b) with allocation of the rape seed meal by-product

Likewise, the recalculation can also be carried out based on rape seed oil biodiesel (29 g of CO_2 eq./MJ). This would require glycerol also to be factored into the conversion rate and allocation, causing the value calculated for Luxembourg to decrease proportionally from 23.6 to 22.6 g of CO_2 eq./MJ).

5 Conclusion

The above results show that for Luxembourg (as a uniform region at NUTS 2 level) the greenhouse gas emissions for the cultivation of wheat and rape for biofuels are below the disaggregated default values (= typical values) from Part D of Annex V [sic] of the EU Renewable Energy Directive. Account was taken of the factors typical of the region, such as soil characteristics, climate and expected raw material yields, by employing a method similar to that used to calculate the default values.

On this basis, the Grand Duchy of Luxembourg can report to the European Commission that the default values can be used in accordance with Article 19(2) for these agricultural raw materials and the biofuels produced therefrom.

6 Bibliography

JRC (2008) Update on Data on pathways for RES Directive.XLS, semi-public file, spreadsheet file sent by the Commission in November 2008 to various interested parties

JEC (2007) JRC, EUCAR, CONCAWE: Well-to-Wheels analysis of future automotive fuels and powertrains in the European context WELL-TO-TANK Report Version 2c, Appendix 1; March 2007

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Subject: **Corrigendum to the report** in accordance with Article 19(2) of Directive 2009/28/EC on the promotion of the use of energy from renewable sources and amending and subsequently repealing Directives 2001/77/EC and 2003/30/EC and with Article 7d(2) of Directive 2009/30/EC amending Directive 98/70/EC as regards the specification of petrol, diesel and gas-oil and introducing a mechanism to monitor and reduce greenhouse gas emissions and amending Council Directive 1999/32/EC as regards the specification of fuel used by inland waterway vessels and repealing Directive 93/12/EEC

Ref.: Ares(2011)303609 - 18/03/2011

I refer to our letter No 20413 dated 10 August 2011. Please find below a corrigendum to the above report.

The corrigendum concerns paragraph 4 of Chapter 1 ('Background') of the report entitled 'Determination of disaggregated default values for the reporting obligation laid down in Article 19(2) under the Directive on the promotion of the use of energy from renewable sources (2009/28/EC) and in Article 7d(2) under the Directive as regards the specification of petrol, diesel and gas-oil and introducing a mechanism to monitor and reduce greenhouse gas emissions (2009/30/EC) for Luxembourg'. The words '*Disaggregated default values for cultivation* in Part D of Annex V to this Directive' in this paragraph of the report should be replaced by the words '*Disaggregated default values for cultivation* in Part D of Annex IV to this Directive'.

(Complimentary close)