Additional information

relating to the

REPORT ON GREENHOUSE GAS EMISSIONS FROM THE CULTIVATION OF AGRICULTURAL CROPS USED AS RAW MATERIALS FOR BIOFUEL PRODUCTION

Sofia, July 2012

This additional information relating to the report submitted by Bulgaria in October 2011 under:

- Article 7d(2) of Directive 2009/30/EC of the European Parliament and of the Council of 23 April 2009 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 and
- Article 19(2) of Directive 2009/28/EC of the European Parliament and of the Council of 23 April 2009 on the promotion of the use of energy from renewable sources and amending and subsequently repealing Directives 2001/77/EC and 2003/30/EC,

has been drawn up in response to a letter dated 30 January 2012 from DG ENER.

ANNEX 1

1. **CALCULATION OF GREENHOUSE GAS EMISSIONS FROM THE CULTIVATION OF AGRICULTURAL CROPS USED AS RAW MATERIALS FOR BIOFUEL PRODUCTION**

$e_{ec} = e_{FERT} + e_{PPP} + e_{SEEDS} + e_{N2O} + e_{FUEL}$

e_{FERT} – emissions from production of fertilisers

e_{PPP} – emissions from application of plant protection products

e_{SEEDS} – emissions from seeds

e_{N2O} – direct and indirect emissions N_2O according to IPCC 2006 Guidelines

e_{FUEL} – emissions from fossil fuel consumption

All emission sources are calculated in kg CO_2eq/ha.

At the end, the calculations are converted into g CO_2eq/MJ fuel.

In order to ensure the transparency and traceability of the results and to allow for re-calculation, all input data and calculations are set out below.

Input data

- Emission factors – Table 1

	Emission factor, kg CO_{2eq}/kg	source
N	5.8806	BioGrace
P_2O_5	1.0107	BioGrace
K_2O	0.5761	BioGrace

Pesticides	10.971	BioGrace
Rapeseed	0.7299	BioGrace
Maize	0	BioGrace
Sunflower	0.7299	BioGrace
Wheat	0.2759	BioGrace
Diesel fuel	3.254	National Inventory

- Average yields – Table 2

Table 2. Biofuel yield from agricultural crops and allocation on the basis of the energy content of the biofuels and by-products

Crop	Product	Average biofuel yield	Allocation on the basis of energy content, AF %	Information source
1. Rapeseed	Biodiesel	2.45 t rapeseed per tonne of biodiesel and 1 406 kg meal and 90 kg glycerol	61.37%	National Biofuels Association
2. Sunflower	Biodiesel	2.54 t sunflower per tonne of biodiesel and 963 kg meal and 90 kg glycerol	69.27%	National Biofuels Association
3. Wheat	Bioethanol	3.55 t wheat per tonne of bioethanol and	75.15%	Evroetil (bioethanol

Crop	Product	Average biofuel yield	Allocation on the basis of energy content, AF %	Information source
		520 kg DDGS (8-10% moisture)		producer)
4. Maize	Bioethanol	3,17 t maize per tonne of bioethanol and 460 kg DDGS	77.37%	Evroetil

The lower calorific value (LCV) of biodiesel is 37 MJ/kg (information from National Statistical Institute – NSI)

The lower calorific value of glycerol is 16.75 MJ/kg.

The lower calorific value of meal is 15.49 MJ/kg.

The lower calorific value of bioethanol is 26.74 MJ/kg (Technical University of Varna)

The lower calorific value of DDGS is 17 MJ/kg (National Biofuels Association of Bulgaria - NABB).

1.1. Emissions from fertiliser production

Emissions from fertiliser production are calculated using the following equation:

e_{FERT} (kg CO_2eq/ha) = quantity of fertilisers (kg/ha) x emission factor (kg CO_2eq/kg nutrient)

Table 3. Average quantity of nutrients in relation to agricultural crop yield (kg/ha)

NUTS 2 region	**Yield**	**Average amount of fertilisers used (kg/h)**

		N	P_2O_5	K_2O	Total
WHEAT					
North-West	3067	53.87	9.47	4.01	67.35
North-Central	3453	60.65	10.66	4.52	75.82
North-East	3866	67.90	11.93	5.06	84.89
South-East	3343	58.72	10.32	4.37	73.41
South-West	2836	49.81	8.75	3.71	62.27
South-Central	2847	50.01	8.79	3.72	62.52
MAIZE					
North-West	3601	49.86	8.76	3.71	62.34
North-Central	3943	54.60	9.59	4.07	68.26
North-East	4366	60.46	10.62	4.50	75.58
South-East	4638	64.22	11.28	4.78	80.29
South-West	3933	54.46	9.57	4.06	68.09
South-Central	4142	57.35	10.08	4.27	71.70
SUNFLOWER					
North-West	1649	57.83	10.16	4.31	72.29
North-Central	1844	64.66	11.36	4.81	80.84
North-East	1936	67.89	11.93	5.06	84.87
South-East	1524	53.44	9.39	3.98	66.81
South-West	1322	46.36	8.15	3.45	57.96
South-Central	1448	50.78	8.92	3.78	63.48
RAPESEED					
North-West	2719	64.10	11.26	4.77	80.14

NUTS 2 region	Yield	Average amount of fertilisers used (kg/h)			
	kg/ha	N	P_2O_5	K_2O	Total
North-Central	1864	43.95	7.72	3.27	54.94
North-East	2746	64.74	11.38	4.82	80.94
South-East	2273	53.59	9.42	3.99	66.99
South-West	2431	57.31	10.07	4.27	71.65
South-Central	2429	57.27	10.06	4.26	71.59

The average amounts of fertiliser are determined on the basis of the data referred to in the basic report and the supplements thereto (Bulletin No 135, 2009, National Agricultural Reports). The proportion of fertilised land in relation to the entire harvested area is taken into account, and the average amount of fertiliser used relates to the entire harvested area, including both fertilised and non-fertilised land.

The emission factors for nitrogen-, phosphorus- and potassium-based fertilisers are as follows:

N fertilisers – 5.8806 kg CO_{2eq}/kg

P_2O_5 fertilisers – 1.0107 kg CO_{2eq}/kg

K_2O fertilisers – 0.5761 kg CO_{2eq}/kg

Table 4. Emissions from fertiliser production

NUTS2	Emissions, kg CO_{2eq}/kg per ha of nutrient			Total
	N	P_2O_5	K_2O	kg CO_{2eq}/ha
WHEAT				
North-West	316.79	9.57	2.31	328.66

North-Central	356.66	10.77	2.60	370.03
North-East	399.31	12.06	2.91	414.29
South-East	345.29	10.43	2.52	358.24
South-West	292.93	8.85	2.14	303.91
South-Central	294.06	8.88	2.15	305.09
MAIZE				
North-West	293.23	8.86	2.14	304.22
North-Central	321.08	9.70	2.34	333.12
North-East	355.52	10.74	2.59	368.85
South-East	377.67	11.41	2.75	391.83
South-West	320.26	9.67	2.34	332.27
South-Central	337.28	10.19	2.46	349.93
SUNFLOWER				
North-West	340.05	10.27	2.48	352.80
North-Central	380.26	11.48	2.77	394.52
North-East	399.23	12.06	2.91	414.20
South-East	314.27	9.49	2.29	326.06
South-West	272.62	8.23	1.99	282.84
South-Central	298.60	9.02	2.18	309.80
RAPESEED				
North-West	376.97	11.38	2.75	391.10
North-Central	258.43	7.80	1.89	268.12
North-East	380.71	11.50	2.78	394.99
South-East	315.13	9.52	2.30	326.95

South-West	337.04	10.18	2.46	349.68
South-Central	336.76	10.17	2.46	349.39

1.2. EMISSIONS FROM PESTICIDES (ePPP)

Emissions from pesticides are calculated using the following equation:

ePPP (kg CO_{2eq}/ha) = amount of pesticides (kg/ha) x emission factor (kg CO_{2eq}/kg)

Table 5. Emissions from pesticides

NUTS2	Pesticides		
	Amount, kg/ha	**Emission factor, kg CO_{2eq}/kg (BioGrace)**	**Emissions, kg CO_{2eq}/ha**
WHEAT	0.4	10.971	4.388
MAIZE	0.4	10.971	4.388
SUNFLOWER	0.4	10.971	4.388
RAPESEED	0.4	10.971	4.388

1.3 Emissions from seeds (eSEEDS)

Emissions are calculated using the following equation:

eSEEDS (kg CO_2eq/ha) = amount of seeds (kg/ha) x emission factor (kg CO_2eq/kg seeds)

Amount of seed:

Wheat – 220 kg/ha

Maize – 25 kg/ha

Sunflower – 5 kg/ha

Rapeseed – 8 kg/ha

The emission factors have been obtained from BioGrace and are as follows:

Emission factor – wheat = 0.2759 **kg CO_2eq/kg seeds** (BioGrace)

Emission factor – maize = 0.0 (BioGrace)

Emission factor – sunflower = 0.7299 **kg CO_2eq/kg seeds** (BioGrace)

Emission factor – rapeseed = 0.7299 **kg CO_2eq/kg seeds** (BioGrace)

Table 6. Emissions from seeds

Agricultural crop	**Amount, kg/ha**	**Emission factor, kg CO_2eq/kg (BioGrace)**	**Emissions, kg CO_2eq/ha**
WHEAT	220	0.2759	60.69
MAIZE	25	0.0	0
SUNFLOWER	5	0.7299	3.64
RAPESEED	8	0.7299	5.84

1.4. N_2O emissions

These are calculated using the following equation (IPCC 2006 Guideline):

N_2O emissions = eN_2ODIRECT + e N_2OINDIRECT

Table 7. Factors used to estimate direct and indirect emissions of N_2O

Factor	Unit	Value	Source
EF_1 (direct emissions) N_2O	kg N_2O-N/kgN	0.01 (0.003-0.03)	IPCC, 2006
EF_4 (indirect N_2O emissions from volatilisation and deposition)	kg N_2O-N/kg(NH_3-N+NOx-N)	0.01 (0.002-0.05)	IPCC, 2006
EF_5 (indirect, from leaching)	kg N_2O-N/kg N	0.0075 (0.0005-0.025)	IPCC, 2006
$FRAC_{GASF}$ (fraction of N that volatilises as NH_3 and NOx)	kg (NH_3-n+NOx-N)/kg N	0.1 (0.03-0.03)	IPCC, 2006
$FRAC_{LEACH}$ (fraction of N lost through leaching/run-off)	kg N /kg N	0.3 (0.1-0.8)	IPCC, 2006

Conversion of N_2O-N emissions to N_2O emissions is performed by using the following equation (2006 IPCC Guidelines):

$$N_2O = N_2O\text{-}N \times 44/28$$

The values for the following greenhouse gases are used for the purpose of conversion into g CO_{2eq} (Directive 2009/28/EC, Annex V(C))

Table 8:

Gas	Value after conversion
1g CO_2	1 g CO_{2eq}
1g CH_4	23 g CO_{2eq}.
1g N_2O	296 g CO_{2eq}

1.4.1 Direct emissions - N_2O DIRECT

Direct emissions are calculated using the following equation (2006 IPCC Guidelines):

N_2ODIRECT (kg CO_{2eq}/ha) = (FSN + FCR) x EF1 x 44/28 * 296

F_{SN} = annual amount of synthetic fertiliser N applied to soils, kg N yr^{-1}

F_{CR} = amount of N in crop residues (above- and below-ground), including N-fixing crops, and from forage/pasture renewal, returned to soils annually in regions where leaching/runoff occurs, kg N yr^{-1}

N_2O losses from applied N fertilisers are assumed to be 1% of the amount used (IPPC, 2006).

Table 9. Direct N_2O emissions from applied N fertilisers and from crop residues (above ground) + root residues (below ground)

NUTS 2	Average yield	Amount of N fertiliser	N_2O-N losses from fertilisers	N_2O-N losses from crop residues (above- and below-ground)	N_2O total	N_2O emissions
Measure	**kg/ha**	**kg/ha**	**kg/ha**	**kg/ha**	**kg/ha**	**kg CO_{2eq}/ha**
Wheat						
North-West	3067	53.87	0.54	0.779	1.225	362.57
North-Central	3453	60.65	0.61	0.876	1.377	407.56
North-East	3866	67.90	0.68	0.982	1.540	455.70
South-East	3343	58.72	0.59	0.849	1.334	394.74
South-West	2836	49.81	0.50	0.722	1.134	336.64
South-Central	2847	50.01	0.50	0.724	1.138	336.93

Maize						
North-West	3601	49.86	0.50	0.835	1.312	388.22
North-Central	3943	54.60	0.55	0.910	1.429	423.11
North-East	4366	60.46	0.61	1.002	1.575	466.36
South-East	4638	64.22	0.64	1.062	1.669	494.00
South-West	3933	54.46	0.54	0.907	1.426	422.09
South-Central	4142	57.35	0.57	0.953	1.498	443.41
Sunflower						
North-West	1649	57.83	0.58	0.756	1.188	351.62
North-Central	1844	64.66	0.65	0.844	1.326	392.37
North-East	1936	67.89	0.68	0.885	1.391	411.60
South-East	1524	53.44	0.53	0.700	1.100	325.50
South-West	1322	46.36	0.46	0.609	0.957	283.29
South-Central	1448	50.78	0.51	0.669	1.046	309.62
Rapeseed						
North-West	2719	64.10	0.64	0.946	1.487	440.17
North-Central	1864	43.95	0.44	0.670	1.052	311.51
North-East	2746	64.74	0.65	0.955	1.501	444.23
South-East	2273	53.59	0.54	0.802	1.26	373.06
South-West	2431	57.31	0.57	0.853	1.341	396.83
South-Central	2429	57.27	0.57	0.852	1.34	396.53

In accordance with Table 11.2 in Chapter 11 of Part 4 of the 2006 IPCC Guidelines, the ratio of below-ground biomass to above-ground biomass residues is 0.22 (only for wheat is it 0.24).

In accordance with Table 11.2 in Chapter 11 of Part 4 of the 2006 IPCC Guidelines, the N content of the below-ground portion of rapeseed is 0.9%; the corresponding figures for maize and wheat are 0.7% and 0.9%, respectively.

In accordance with Table 11.2 in Chapter 11 of Part 4 of the 2006 IPCC Guidelines, the N content of the above-ground portion of rapeseed, sunflower and maize is 0.6%. For wheat, we used a value of 0.3%, the relevant data being taken from research carried out at the Agricultural University of Plovdiv.

1.4.2 INDIRECT EMISSIONS (N_2OINDIRECT)

Indirect emissions are calculated using the following equation (in accordance with the 2006 IPCC Guidelines):

$$N_2OINDIRECT\ (kg\ CO_2eq/ha) = N_2O_{(ATD)}\text{-}N + N_2O(L)\text{-}N$$

where:

$N_2O_{(ATD)}$-N= annual amount of N_2O–N from atmospheric deposition, kg N_2O–N yr^{-1}

$N_2O_{(L)}$-N = annual amount of N_2O–N from leaching and run-off in regions where leaching and run-off occur, kg N_2O–N yr^{-1}

$$N_2O_{(ATD)}\text{-}N = [(FSN \times Fracf_{GASF}) + (F_{ON} + F_{PRP}) \times Frac_{GASM})] \times EF_4$$

F_{SN} = annual amount of synthetic fertiliser N, kg N yr^{-1}

$Fracf_{GASF}$ = fraction of synthetic fertiliser N that volatilises as NH_3 и NO_X, kg N (kg of N applied)$^{-1}$

F_{ON} = annual amount of livestock manure, compost, sewage sludge and other organic N additions applied to soils, kg N yr^{-1}

F_{PRP} = annual amount of urine and dung N deposited by grazing animals on pasture, kg N yr^{-1}

$Frac_{GASM}$ = fraction of applied organic N fertiliser materials (F_{ON}) that volatilises as NH_3 and NO_X, kg N volatilised (kg of N applied or deposited)$^{-1}$

EF_4 = emission factor for N_2O emissions from atmospheric deposition of N on soils and water surfaces, [kg $N–N_2O$ (kg $NH_3–N + NO_X–N$ volatilised)$^{-1}$]

$$N_2O_{(L)}\text{-}N = (F_{SN} + F_{ON} + F_{PRP} + F_{CR} + F_{SOM}) \times Frac_{LEACH\text{-}(H)} \times EF_5$$

F_{SN} = annual amount of synthetic fertiliser N, kg N yr^{-1}

F_{ON} = annual amount of livestock manure, compost, sewage sludge and other organic N additions applied to soils in regions where leaching/run-off occurs, kg N yr^{-1}

F_{PRP} = annual amount of urine and dung N deposited by grazing animals on pasture in regions where leaching/run-off occurs, kg N yr^{-1}

F_{CR} = amount of N in crop residues (above- and below-ground), including N-fixing crops, and from pasture renewal, in regions where leaching/runoff occurs, kg N yr^{-1}

F_{SOM} = annual amount of N mineralised in mineral soils associated with loss of organic C from organic matter as a result of land use in regions where leaching/runoff occurs, kg N yr^{-1}

$Frac_{LEACH\text{-}(H)}$ = fraction of all N added to/mineralised in soils in regions where leaching/runoff occurs that is lost through leaching and runoff, kg N yr^{-1}

EF_5 = emission factor for N_2O emissions from N leaching and run-off, kg $N_2O–N$ (kg N leached and run-off)$^{-1}$

The calculations do not take into account the factors F_{ON} (organic fertilisers are not applied to the crops concerned in Bulgaria), F_{PRP} (these crops are grown on arable land), F_{SOM} (these crops are not grown on such land in Bulgaria).

Leaching/run-off covers losses from fertilisers and agricultural crop residues.

The yield (amount) of such residues is calculated from the ratio of above-ground residues dry matter (AG dm which is given in tons/ha) to harvested yield for crop (Crop T given in kg/ha) as: AD dm * 1000 / CROP T (IPCC 2006). The RAG for rapeseed is around 1.5 then. In the case of maize this ratio is 1,2. The ratio for wheat (on the basis of data from the Agricultural University of Plovdiv) and for sunflower is 1.3. Data from the Faculty of Agronomy of the Agricultural University of Plovdiv (Bozhinov, Gerzilov and Penkov) was also used for the nitrogen content in crop residues (straw) for wheat, which is 0.0028.

Table 10. Indirect N_2O emissions from atmospheric deposition of volatilised N and N_20-N from leaching and run-off

NUTS 2	yield, kg/ha	N input, kg/ha	N_20-N from atmospheric deposition, kg/ha	N_20-N from leaching and run-off, kg/ha	Total N_20 emissions, kg/ha	Total indirect N_2O emissions, kg CO_{2eq}/ha
WHEAT						
North-West	3067	53.87	0.054	0.175	0.276	106.64
North-Central	3453	60.65	0.061	0.197	0.310	119.91
North-East	3866	67.90	0.068	0.220	0.346	134.12
South-East	3343	58.72	0.059	0.191	0.300	116.13
South-West	2836	49.81	0.050	0.162	0.255	98.69
South-Central	2847	50.01	0.050	0.163	0.256	99.07
MAIZE						
North-West	3601	49.86	0.050	0.188	0.295	110.54
North-Central	3943	54.60	0.055	0.205	0.322	120.60
North-East	4366	60.46	0.060	0.006	0.354	133.03
South-East	4638	64.22	0.064	0.239	0.376	141.02
South-West	3933	54.46	0.054	0.204	0.321	120.30
South-Central	4142	57.35	0.057	0.214	0.337	126.44
SUNFLOWER						
North-West	1649	57.83	0.058	0.170	0.267	106.01
North-Central	1844	64.66	0.065	0.190	0.298	118.36

NUTS 2	yield, kg/ha	N input, kg/ha	N_20-N from atmospheric deposition, kg/ha	N_20-N from leaching and run-off, kg/ha	Total N_20 emissions, kg/ha	Total indirect N_2O emissions, kg CO_{2eq}/ha
North-East	1936	67.89	0.068	0.199	0.313	124.19
South-East	1524	53.44	0.053	0.157	0.247	98.10
South-West	1322	46.36	0.046	0.137	0.215	85.30
South-Central	1448	50.78	0.051	0.150	0.235	93.28
RAPESEED						
North-West	2719	64.10	0.064	0.213	0.335	128.86
North-Central	1864	43.95	0.044	0.151	0.237	90.53
North-East	2746	64.74	0.065	0.215	0.338	130.07
South-East	2273	53.59	0.054	0.180	0.284	108.86
South-West	2431	57.31	0.057	0.192	0.302	116.95
South-Central	2429	57.27	0.057	0.192	0.301	115.86

1.5 Emissions from agricultural machinery and technological operations (fuel use)

eFUEL = fuel (L/ha) x density (kg/m3) x emission factor

The average consumption of diesel fuel during the cultivation process is 73 h/l (rate specified in Article 37(2) of the Act on excise duties and tax warehouses).

To calculate emissions in kg CO_{2eq}/ha, an emission factor of 3.254 kg CO_2/kg is used, determined on the basis of the following individual emission factors (National Inventory 2010):

EF CO_2 = 76.1404 t/TJ;

EF CH_4 = 9.8433 kg/TJ

EF N_2O = 1.9107 kg/TJ

eFUEL = 200.79 kg CO_{2eq}/ha

4. Final results

Typical emissions = eec = $e_{FERT} + e_{PPP} + e_{SEEDS} + e_{N2O} + e_{FUEL}$

In accordance with Directive 2009/28/EC, emissions must be expressed in g CO_{2eq}/MJ fuel.

The values calculated in kg CO_{2eq}/ha are converted into g CO_{2eq}/MJ using the following equation:

$$g\ CO_2eq/MJ = \frac{Emissions\ (g\ CO_2eq/ha) \times allocation\ factor\ AF}{yield\ (kg/ha) \times energy\ content\ (MJ/kg)}$$

Calculation of the energy balance is based on the following data:

According to Evroetil, a bioethanol producer, 3.17 tonnes of maize yields one litre of bioethanol. The lower calorific value of bioethanol is 26.74 MJ/l (Technical University of Varna). The by-product is DDGS (460 kg), with a lower calorific value (LCV) of 17 MJ/kg.

Data from Evroetil also shows that 3.55 tonnes of wheat yields one tonne of bioethanol and 520 kg of DDGS (8-10% moisture).

According to the National Biofuels Association, 2.45 tonnes of rapeseed yields 1 tonne of biodiesel, 1 406 kg of meal and 90 kg of glycerol, whereas 2.54 tonnes of sunflower yields 1 tonne of biodiesel, 963 kg of meal and 90 kg of glycerol.

According to the National Statistical Institute, the lower calorific value of biodiesel is 37 MJ/kg, whilst that of glycerol is 16.75 MJ/kg , and that of oilseed meal is 15.49 MJ/kg.

Research at the Technical University of Varna shows that the lower calorific value of bioethanol is 26.74 MJ/kg, and, according to the National Biofuels Association, the lower calorific value of DDGS is 17 MJ/kg.

Table 11. Product yield and allocation according to energy content

Crop	Product	Average yield, kg/l	Allocation factor according to energy content – AF, %
Wheat	Bioethanol	3.55	75.15%
Maize	Bioethanol	3.17	77.37%
Sunflower	Biodiesel	2.54	69.74%
Rapeseed	Biodiesel	2.45	61.37%

Table 12. Calculation of typical emissions from cultivation of wheat, kg CO_{2eq}/ha

	Total, kg CO_{2eq}/ha	Allocation factor	Total, g CO_{2eq}/MJ
WHEAT			
North-West	1063.74	0.7515	34.61
North-Central	1163.37	0.7515	33.62
North-East	1269.08	0.7515	32.75
South-East	1134.98	0.7515	33.88
South-West	1004.12	0.7515	35.34
South-Central	1006.96	0.7515	35.30
Directive			23

Table 13. Calculation of typical emissions from cultivation of maize, kg CO_{2eq}/ha

	Total, kg CO_{2eq}/ha	Allocation factor	Total, g CO_{2eq}/MJ
MAIZE			
North-West	1008.16	0.7515	25.57
North-Central	1081.99	0.7515	25.06
North-East	1173.31	0.7515	24.55
South-East	1232.03	0.7515	24.26
South-West	1079.83	0.7515	25.08
South-Central	1124.95	0.7515	24.81
Directive			20

Table 14. Calculation of typical emissions from cultivation of sunflower, kg CO_{2eq}/ha

	Total, kg CO_{2eq}/ha	***Allocation factor***	***Total, g CO_{2eq}/MJ***
SUNFLOWER			
North-West	1019.26	0.7515	29.27
North-Central	1114.08	0.7515	28.61
North-East	1158.81	0.7515	28.35
South-East	958.48	0.7515	29.78
South-West	860.25	0.7515	30.82
South-Central	921.52	0.7515	30.14
Directive			18

Table 15. Calculation of typical emissions from cultivation of rapeseed, kg CO2eq/ha

	Total, kg CO_2eq/ha	*Allocation factor*	*Total, g CO_2eq/MJ*
RAPESEED			
North-West	1171.15	0.7515	17.51
North-Central	881.17	0.7515	19.22
North-East	1180.30	0.7515	17.48
South-East	1019.88	0.7515	18.24
South-West	1073.47	0.7515	17.96
South-Central	1072.79	0.7515	17.95
Directive			29

Conclusion:

From the calculations we have made of greenhouse gas emissions from the cultivation of raw materials for biofuel production, we can conclude that greenhouse gas emissions from the cultivation of rapeseed do not exceed the values specified in the 'Disaggregated default values for cultivation' table in Part D of Annex IV to Directive 2009/30/EC and in Part D of Annex V to Directive 2009/28/EC in any of Bulgaria's six NUTS 2 regions. This **means that a simplified method of calculating greenhouse gas emissions may be used for this agricultural crop, by applying the:**

- **default values for greenhouse gas emission saving, as set out in the table in Part A of Annex IV to Directive 2009/30/EC and Annex V to Directive 2009/28/EC, and the**
- **disaggregated default values for cultivation, as set out in the table of the same name in Part D of Annex IV to Directive 2009/30/EC and Annex V to Directive 2009/28/EC .**