Addendum 002 – RFA Carbon and Sustainability Reporting Guidance, Part 2

3 Editing pre-defined fuel chains with actual data

Actual data for crop production

– Version 1.1: page 7.

It will be permissible for evidence in support of actual data provided for crop production to take the form of a statistically accurate survey of farm level data. Such surveys would be considered valid for one crop growing season and should be based on:

- data specific to an individual field or,
- average data for all crops produced on a farm (e.g. if a farmer has the following two fields of wheat, the average crop yield of 11.2 t/ha could be reported, rather than the individual crop yields: Field 1: 20 ha, 200 t; Field 2: 32 ha; 384 t). Note: this approach can also be used outside of a surveying context

Reason for changes

- The revision above will enable more reporting of actual data that would be the case with the current specification, because:
  - Farmers regularly mix feed wheat (and other crops) in storage.
  - Crop storage differs from other storage situations (e.g. vegetable oil storage at biodiesel plant) because most farmers will not have a verifiable record of the quantities of crop going into the storage. In general the crop will not be accurately weighed until it has left the farm. Increasingly farmers will have this information pre-storage, as crop yield monitors are installed in harvesters, however, these are not universally used and their accuracy is unknown. Because they have no verifiable record of the weight of crop going into storage, farmers cannot operate a mass balance on the storage facility.
  - Farmers can keep crop from individual fields separate (and therefore a mass balance at storage would not be required) – but this is costly and generally only done for higher value crops. It is unlikely a farmer would keep biofuel crops separate.
  - Requiring field-based reporting would probably mean that few people would report of actual data.

3.5 General Default values

Table 9 – Fossil fuel emission factors

– Version 1.1: page 18

	Emissions factor [kgCO_2e/MJ fuel]
Diesel	0.0864
Heavy fuel oil	0.0873
Coal	0.112
Natural gas	0.0620

Reason for changes

- In version 1.1 the above emissions factors were rounded to three decimal places, however, four have been used in all default value calculations.

5 Sugar beet to ethanol

Fuel chain summary

– Version 1.1: page 36

	Carbon intensity [kg CO2/t ethanol]			
Module	**Brazil**	**Mozambique**	**Pakistan**	**South Africa**
1 – Crop production	348	425	597	425
2 – Feedstock transport	49	53	49	53
3 – Conversion	0	0	2152	2219
4 – Liquid fuel transport	93	101	93	101
5 – Liquid fuel transport	175	237	203	227
TOTAL	665	816	3094	3025

Reason for changes

- Stage 1 – Crop production: previously did not take into account the nitrogen content of the phosphorus fertiliser used (mono ammonium phosphate) when calculating N_2O emissions from soils.
- Stage 4 – Liquid fuel transport: an incorrect emissions factor was used in the spreadsheet calculations (the emissions factor for heavy fuel oil was used, while the single default value is diesel).

Default value tables

– Version 1.1: page 39

Stage/Input	Units	Feedstock Country of Origin			
		Brazil	**Pakistan**	**South Africa**	**Mozambique**

Stage/Input	Units	Feedstock Country of Origin			
		Brazil	**Pakistan**	**South Africa**	**Mozambique**
Stage 5 – Liquid fuel transport and storage					
Transport distance	[km]	10000	11600	13000	13600
Fuel consumption	[MJ/t-km]	0.2	0.2	0.2	0.2
Fuel Type		HFO	HFO	HFO	HFO

Reason for changes

- Stage 5 – Liquid fuel transport: the fuel type for this transport step was incorrectly recorded (as diesel) in version 1.1. The correct fuel type, which was used in all default value calculations, is HFO.

7 Molasses to Ethanol

Fuel chain summary

– Version 1.1: page 40

	Carbon intensity [kg CO2/t ethanol]		
Module	**Pakistan**	**South Africa**	**UK**
1 – Feedstock transport	101	109	
2 – Conversion	1679	1920	
3 – Liquid fuel transport	93	101	
4 – Liquid fuel transport	203	227	
TOTAL	2076	2357	

Reason for changes

- Stage 1 – feedstock transport: error in spreadsheet formula converting the module total to the total contribution to fuel chain.

9 Oilseed rape to ME biodiesel

Default value tables

– Version 1.1: page 53

Stage/Input	**Units**	**Feedstock country of origin**							
		Australia	**Canada**	**Finland**	**France**	**Germany**	**Poland**	**Ukraine**	**United Kingdom**
Stage 1 – Crop production									
Yield @ traded moisture content	[t/ha.a]	1.19	1.46	1.30	3.18	3.44	2.38	1.12	3.03
Traded moisture content	%	9	9	9	9	9	9	9	9
N fertiliser	[kg N /ha.a]	61	75	67	155	170	102	60	185
Type of N fertiliser		AN	AN	AN	AN	AN	AN	AN	AN
P fertiliser	[kg P_2O_5/ha.a]	16	20	18	45	45	35	15	45
Type of P fertiliser		TSP	TSP	TSP	TSP	TSP	TSP	TSP	TSP
K fertiliser	[kg K_2O/ha.a]	12	15	13	80	90	44	12	48
Lime	[kg CaO/ha.a]	271	271	271	271	271	271	271	271
Pesticides	[kg/ha.a]	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28

Stage/Input	Units	Feedstock country of origin							
		Australia	**Canada**	**Finland**	**France**	**Germany**	**Poland**	**Ukraine**	**United Kingdom**
Diesel fuel consumption	[litres/ha.a]	66	66	66	66	66	66	66	66

Reason for changes

- Stage 1 – Crop production: lime application rate was incorrectly recorded in version 1.1. The correct application rate, which was used in all default value calculations, is 271.

11 Palm to ME biodiesel

Fuel chain summary

– Version 1.1: page 74

	Carbon intensity [kg CO2/t biodiesel]	
	Indonesia	**Malaysia**
1 – Crop Production	344	313
2 – Feedstock transport	11	11
3 – Conversion (palm oil extraction)	520	520
4 – Feedstock transport	63	39
5 – Conversion (palm oil refining)	117	109
6 – Feedstock transport	248	248
7 – Conversion (esterification)	471	471
8 – Liquid fuel transport	0	0
TOTAL	1742	1743

Reason for changes

- Stage 1 – crop production: previously did not take into account the nitrogen content of the NPK fertiliser when calculating N_2O emissions from soils.

12 Used cooking oil and tallow to ME biodiesel

– *Version 1.1: page 86-89*

- This section has been split into two separate fuel chains: Used cooking oil to ME biodiesel and Tallow to biodiesel
- All data, calculations and assumptions remain the same.
- A new country of origin, Denmark, has been added for Tallow to ME biodiesel. The key assumptions are that tallow from Denmark is transported 250 kilometres by road and then 600 kilometres by sea.
- Another new country of origin, United States of America, has been added for Tallow to ME biodiesel. The key assumptions are that tallow from the USA is transported 1500 kilometres by rail and then 7000 kilometres by sea.

14 Soy to HVO biodiesel

Fuel chain summary

– Version 1.1: page 97

	Carbon intensity [kg CO2/t biodiesel]		
	Argentina	**Brazil**	**USA**
1 – Crop production			3124
2 – Drying and storage			79
3 – Feedstock transport			91
4 – Conversion (crushing)			-1278
5 – Feedstock transport			30
6 – Feedstock transport			183
7 – Conversion (hydrogenation)			488
8 – Liquid fuel transport			35
TOTAL			2752

Reason for changes

- Stage 1 – Crop production: a rounding error in the spreadsheet.
- Stage 5 – Feedstock transport: an incorrect emissions factor was used in the spreadsheet calculations (the emissions factor for heavy fuel oil was used, while the single default value is diesel).

15 Palm to HVO biodiesel

Fuel chain summary

– Version 1.1: page 103

	Carbon intensity [kg CO2/t biodiesel]	
	Indonesia	**Malaysia**
1 – Crop Production	406	447
2 – Feedstock transport	14	14
3 – Conversion (palm oil extraction)	675	675
4 – Feedstock transport	82	51
5 – Conversion (palm oil refining)	152	142
6 – Feedstock transport	354	354
7 – Conversion (esterification)	488	488
8 – Liquid fuel transport	35	35
TOTAL	2206	2206

Reason for changes

- Stage 1 – crop production: previously did not take into account the nitrogen content of the NPK fertiliser when calculating N_2O emissions from soils.

16 Ethanol to ETBE

Fuel chain summary

– Version 1.1: page 110-112

ETBE produced using refinery by-product isobutene

Feedstock	Wheat				
Origin	**Canada**	**France**	**Germany**	**Ukraine**	**United Kingdom**
1 - Conversion				2919	
2 - Liquid fuel transport & storage				8	
TOTAL				2927	

Feedstock	Sugar beet	Molasses		
Origin	**UK**	**Pakistan**	**South Africa**	**UK**
1 - Conversion		2608	2735	
2 - Liquid fuel transport & storage		8	8	
TOTAL		2616	2743	

Feedstock	Sugar cane				Corn	
Origin	**Brazil**	**Mozambique**	**Pakistan**	**South Africa**	**France**	**USA**
1 - Conversion	1974	2040	3069	3036		
2 - Liquid fuel transport & storage	8	8	8	8		
TOTAL	1982	2048	3077	3044		

ETBE produced using isobutene from a dedicated plant

Feedstock	Wheat				
Origin	**Canada**	**France**	**Germany**	**Ukraine**	**United Kingdom**

1 - Conversion				3407	
2 - Liquid fuel transport & storage				8	
TOTAL				3415	

Feedstock	**Sugar beet**	**Molasses**		
Origin	**UK**	**Pakistan**	**South Africa**	**UK**
1 - Conversion		3096	3223	
2 - Liquid fuel transport & storage		8	8	
TOTAL		3104	3231	

Feedstock	**Sugar cane**				**Corn**	
Origin	**Brazil**	**Mozambique**	**Pakistan**	**South Africa**	**France**	**USA**
1 - Conversion	2462	2528	3557	3524		
2 - Liquid fuel transport & storage	8	8	8	8		
TOTAL	2470	2536	3565	3532		

Reason for changes

- Stage 1 – Conversion: all changes are due to the changes made to the ethanol production chain – see above for details.

Default value tables (for both fuel chains)

– Version 1.1: page 115

Stage/Input	**Units**	Refinery isobutene	Imported isobutene
Stage 2 – Liquid fuel transport and storage			
Transport distance	[km]	450	450
Fuel consumption	[MJ/t-km]	0.2	0.2

Fuel Type		HFO	HFO

Reason for changes

- Stage 2 – Liquid fuel transport and storage: transport distance for imported isobutene was incorrectly recorded (400 km) in version 1.1. The correct distance, which was used in all default value calculations, is 450 km.
- Stage 2 – Liquid fuel transport and storage: fuel type was not recorded in version 1.1.

17 Manure and organic solid waste to biomethane

- The fuel chain has been split into two separate chains – manure to biomethane and municipal solid waste to biomethane.
- The module totals have been converted to units of kgCO_2e/tonne biomethane (see below) – they were previously gCO_2e/MJ biomethane.
- No single default values have been changed

Manure to biomethane

Fuel chain summary

– Version 1.1: page 116

	Carbon intensity [kg CO2/t biomethane]
1 – Feedstock transport	290
2 – Conversion	1339
3 – Gaseous fuel transport and storage	0
Total	1630

Reason for changes

- The module totals have been converted to units of kgCO_2e/tonne biomethane – they were previously gCO_2e/MJ biomethane.

Municipal solid waste to biomethane

Fuel chain summary

– Version 1.1: page 116

	Carbon intensity [kg CO2/t biomethane]

1 – Feedstock transport	290
2 – Conversion	1339
3 – Gaseous fuel transport and storage	0
Total	1630

Reason for changes

- The module totals have been converted to units of $kgCO_2e$/tonne biomethane – they were previously gCO_2e/MJ biomethane.