Appendix 19
Greenhouse Gas Emissions Calculations

Carbon Emissions Methodology

The National Greenhouse and Energy Reporting System (NGERS) Technical Guidelines have a section on waste incineration. It is the closest form of process to waste gasification available under the guidelines.

It is under Section 5.5. In this section, we only have two options for determining carbon emissions – Method 1 under section 5.53 (calculation using standard factors) and Method 4 under Part 1.3 (direct measurement).

As we do not have a facility to measure, we will use Method 1 under section 5.53. The method is quoted below, direct form the guidelines:

Method 1 is:

$$E_i = Q_i \times CC_i \times FCC_i \times OF_i \times 3.664$$

where:

E_i is the emissions of carbon dioxide released from the incineration of waste type (***i***) by the plant during the year measured in CO_2-e tonnes.

Q_i is the quantity of waste type (***i***) incinerated by the plant during the year measured in tonnes of wet weight value in accordance with:

(a) Division 2.2.5 for solid fuels; and

(b) Division 2.3.6 for gaseous fuels; and

(c) Division 2.4.6 for liquid fuels.

CC_i is the carbon content of waste type (***i***).

FCC_i is the proportion of carbon in waste type (***i***) that is of fossil origin.

OF_i is the oxidation factor for waste type (***i***).

(2) If waste materials other than clinical wastes have been incinerated by the plant, appropriate values for the carbon content of the waste material incinerated must be derived from Schedule 3.

Q is the quantity of waste and determined by New Energy.

OF is oxidation factor and will be 1 in all cases, as the organics are completely oxidized.

The major uncertainty is deciding the fossil-original carbon content.

NGERS Technical Guidelines advise the user that they "must" derive carbon content from Schedule 3. This is a limited table giving carbon content of standard fuels. The only fuels really relevant are quoted below:

Fuels derived from recycled materials	
Industrial materials and tyres that are derived from fossil fuels, if recycled and combusted to produce heat or electricity	0.585
Non-biomass municipal materials, if recycled and combusted to produce heat or electricity	0.250
Primary solid biomass fuels	
Biomass municipal and industrial materials, if recycled and combusted to produce heat or electricity	0

New Energy has applied the industrial material carbon content to tyres, rubber, and oily wastes in our waste stream.

We have applied the non-biomass municipal carbon content to plastics and textiles in our waste stream.

We have obviously considered all biomass to have a zero fossil-origin carbon content (as per the "biomass municipal and industrial materials…" detailed in the table above).

Carbon Emissions Calculations			
Project Number	Boodarie	Date	17th February 2012
Project Title	Boodarie	Revision	A
Sheet Name		Sheet	1

Consider Boodarie example

TOTAL WASTE STREAM	**fraction mass %**	**component tpa (wet)**
Food	19	17,066
Green	8	6,865
Paper/card	13	11,081
Mixed plastics	14	12,792
PVC	1	907
Textiles	5	4,507
Metals	0	150
Glass (large)	0	114
Other inerts	0	97
Dirt & small rocks/rubble	0	428
Sand, glass & ceramic fines	0	315
Oily waste	1	948
Wood	22	19,514
Rubber	0	416
Tyres	14	12,681
Oil Filters	0	70
Concrete/rubble (large)	0	264
Bricks	0	110
	100	***88,324***

Industrial materials and tyres that are derived from fossil fuels, if recycled and combusted to produce heat or electricity	16	14,115
Non-biomass municipal materials, if recycled and combusted to produce heat or electricity	21	18,207

Using NGERs method 1 under section 5.53 using Schedule 3 carbon contents

Waste Composition	E =	Q x	CC x	FCC x	OF x	3.664
	tpa					
tonnage	88,324					
Component	**mass%**	**mass tpa**	**carbon content CC**	**fossil fraction FCC**	**oxidation factor OF**	**E (CO2eq) tpa**
Food	19.3	17,066	0.000	0.0	1.00	-
Green	7.8	6,865	0.000	0.0	1.00	-
Paper/card	12.5	11,081	0.000	0.0	1.00	-
Mixed plastics	14.5	12,792	0.250	1.0	1.00	11,718
PVC	1.0	907	0.250	1.0	1.00	831
Textiles	5.1	4,507	0.250	1.0	1.00	4,128
Metals	0.2	150	0.000	0.0	1.00	-
Glass (large)	0.1	114	0.000	0.0	1.00	-
Other inerts	0.1	97	0.000	0.0	1.00	-
Dirt & small rocks	0.5	428	0.000	0.0	1.00	-
Sand, glass & ceramic fines	0.4	315	0.000	0.0	1.00	-
Oily waste	1.1	948	0.585	1.0	1.00	2,032
Wood	22.1	19,514	0.000	0.0	1.00	-
Rubber	0.5	416	0.585	1.0	1.00	892
Tyres	14.4	12,681	0.585	1.0	1.00	27,180
Oil Filters	0.1	70	0.585	1.0	1.00	150
Concrete/rubble	0.3	264	0.000	0.0	1.00	-
Bricks	0.1	110	0.000	0.0	1.00	-
	100.00	**88,324**				**46,932**

	E(CO2eq) tpa	**CO2 $/tonne**		**Total Carbon Tax $**	**Total Carbon Tax $/tonne of Waste**
Carbon Tax Calculations	**46,932**	**23**	**$**	**1,079,426**	**12.22**

EXPERIMENTING WITH OTHER METHODS

Using NGERs method 1 under section 2.4 for solid fuel combustion

Waste Composition	E =	(Q x	EC x	EF) /	1000				
	tpa								
tonnage	32,322				Thesea aren't exactly relevant as they are for solid fuel combustion, not gasification				
Waste Type	mass%	**mass tpa**	**energy content EC**	**emission factor CO2 EF**	**emission factor CH4 EF**	**emission factor N2O EF**	**E (CO2eq) tpa**	**E (CO2eq) tpa**	**E (CO2eq) tpa**	**E TOTAL**
Industrial materials and tyres that are derived from fossil fuels, if recycled and combusted to produce heat or electricity	44	14,115	26.3	79.9	0.0	0.2	29,660	7	74	
Non-biomass municipal materials, if recycled and combusted to produce heat or electricity	56	18,207	10.50	85.4	0.6	1.2	16,326	115	229	
		32,322					**45,986**	**122**	**304**	**46,412**