52 Claremont Road
Sandymount
Dublin 4

Friday 26th October 2007

Dr Jonathan Derham
Office of Licensing & Guidance
Environmental Protection Agency
PO Box 3000
Johnstown Castle Estate
County Wexford

Re: WO232-01
Waste Licence Application by Dublin City Council
Dublin Waste to Energy Project
Pigeon House Road
Poolbeg Peninsula
Dublin 4

Dear Dr Derham,

On Monday last, 22nd October 2007, we sent a submission to the EPA enclosing the following material in softcopy:

> *Having visited the EPA headquarters last week it was clear that your file does not contain copies of the two workbooks with spreadsheets provided by Dr Porter in support of the submissions on climate impact which he made on behalf of DCC to An Bórd Pleanála.*
>
> *Please find attached copies of these two workbooks:*
>
> 1. ***Poolbeg 2 original climate_chapter_calculations.xls***
>
> 2. ***Poolbeg 3 original climate_spreadsheet_280507.xls***
>
> *Also please find attached additional material for your consideration:*
>
> 3. ***JPMcC - VJ Critique of Porter Climate Models.xls***
>
> *A copy of our workbook with spreadsheets in which we provide our analysis and reworking of Dr Porter's models.*

Paper material
We received two calls from your Office on Wednesday and Thursday to the effect that the EPA does not place spreadsheets on their website. A paper copy of the material was sought for the website.

We wish to protest that this policy of the EPA is inadequate in the discharge of its duty to inform the public. The material we submitted is essential to the understanding of the climate models produced by Dr Porter on behalf of Dublin City Council.

It is the responsibility of the EPA to check the material submitted as part of any EIS for a waste licence application. It is now clear to us following our analysis that these models as presented by Dr Porter were never checked.

His calculations for the Meath incinerator and for the Poolbeg incinerator have the same mistakes.

Complex Models

Understanding or assessing this complex science requires access to the analysis tools used to create these climate impact models - spreadsheets in this case – and for the EPA to restrict availability to paper format only is a major interference with the public's right to information.

Providing a printout of a spreadsheet on paper is entirely insufficient because the underlying formulae are invisible. The assumptions, calculations, mistakes and other consequences of these complex models can not be assessed without having the actual excel spreadsheets themselves for examination.

We have been in a position to conduct this analysis only because we took part personally in the Oral Hearing conducted by An Bórd Pleanála into the application for the Poolbeg incinerator during which we asked the Inspector to seek a softcopy of the models from the applicant. Having obtained these models during the public hearing we were then able to analyse them and point out the many errors and inconsistencies in the climate models. We have submitted the spreadsheets in their original electronic format to both the EPA and the public to analyse the models.

Who should check the sums? Clearly the EPA did not check these same sums in the case of the Meath application. We were present at the EPA oral hearing in Drogheda when Dr Porter gave evidence and this aspect of his model was not challenged.

Consequences

If this detailed analysis had not been done by us the flaws would never have been seen. One has to wonder at what other flaws are contained in the rest of the EIS.

Similar flaws are present in the published EIS for the Meath incinerator. Please let us know if our new findings change in any way the decision of the EPA to licence the Meath plant. We believe this decision must now be revisited in light of the new facts.

A more important question comes into focus – how can the public have confidence in the self monitoring regimes already licensed by the EPA for similar plants?

Given that mistakes of this magnitude are contained in the application itself it is quite possible that similar mistakes will arise in the self-monitoring of the plant but how can the public or the EPA know that such might be the case?

Monitoring of these facilities which require understanding of the complex science involved should be done directly by the authorities and should not be left to the applicant to self monitor.

Duty to Provide Information
It makes a farce of the regulatory regime if the EPA does not check the sums itself because it has not got them in its possession and at the same time it prevents the public from checking them by refusing to put up the relevant spreadsheets on its website.

Since the EPA will not provide to the public this material as submitted by us we have now placed original copies of the spreadsheets on www.fiasco.ie and we would encourage the public to access the material there.

We are submitting under protest paper copies of these spreadsheets as requested for your website.

The EPA policy of placing paper-only documents on your website is restrictive and should be changed.

Yours sincerely,

Joe McCarthy
Chartered Engineer
BSc FICS MMII DLS CEng MIEI

Yours sincerely,

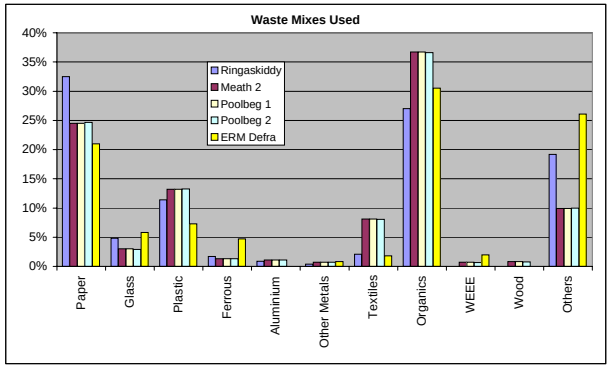
Valerie Jennings
Chartered Physiotherapist
MCSP MISCP LicAcu

Attachments:

Poolbeg 2 original climate_chapter_calculations.pdf
Poolbeg 3 original climate_spreadsheet_280507.pdf
JPMcC - VJ Critique of Porter Climate Models.pdf

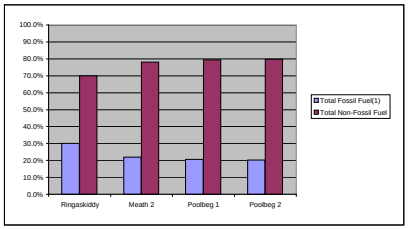
For originals of these spreadsheets please go to www.fiasco.ie

Material	Ringaskiddy	Meath 2	Poolbeg 1	Poolbeg 2	ERM Defra
Paper	32.5%	24.5%	24.5%	24.7%	21.0%
Glass	4.8%	3.0%	3.0%	2.9%	5.8%
Plastic	11.4%	13.2%	13.2%	13.2%	7.3%
Ferrous	1.7%	1.3%	1.3%	1.3%	4.7%
Aluminium	0.9%	1.1%	1.1%	1.1%	0.0%
Other Metals	0.4%	0.7%	0.7%	0.7%	0.8%
Textiles	2.1%	8.1%	8.1%	8.0%	1.8%
Organics	27.0%	36.7%	36.7%	36.6%	30.5%
WEEE	0.0%	0.7%	0.7%	0.7%	2.0%
Wood	0.0%	0.8%	0.8%	0.8%	0.0%
Others	19.2%	9.9%	9.9%	10.0%	26.1%
Material	**Ringaskiddy**	**Meath 2**	**Poolbeg 1**	**Poolbeg 2**	
Total Fossil Fuel[1]	30.0%	21.9%	20.6%	20.1%	
Total Non-Fossil Fuel	70.0%	78.1%	79.4%	79.9%	
Total	100.0%	100.0%	100.0%	100.0%	



Paper	547,849	446,306	446,306	449,957
Glass	80,757	54,643	54,643	53,461
Plastic	192,927	239,986	239,986	241,423
Ferrous	28,491	24,449	24,449	24,204
Aluminium	14,724	20,379	20,379	20,280
Other Metals	6,209	12,230	12,230	12,521
Textiles	36,142	146,986	146,986	146,790
Organics	455,204	667,075	667,075	667,513
WEEE		11,856	11,856	12,312
Wood		14,179	14,179	13,939
Others	323,463	180,432	180,432	181,665
Total Fossil Fuel[1]		398,828	377,660	367,501
Total Non-Fossil Fuel		1,419,693	1,440,870	1,456,564
Total	1,685,766	1,818,521	1,818,530	1,824,065

Fossil fraction	21.9%	20.6%	20.1%
Carbon fraction	40%	29.0%	32.1%



	CO2								Avoid		
	Waste	**CO2**	**Normalised**	**MW**	**Hours**	**MWh**	**MWh/tn**	**CGT Factc**	**Avoided**	**Normalise**	**Net**
Ringaskiddy	150,000	62,700	0.418	6	8,760	52,560	0.35	0.37	19,447	0.130	0.288
Meath 2	200,000	61,028	0.305	13	8,760	113,880	0.57	0.37	42,140	0.211	0.094
Poolbeg 1	600,000	124,857	0.208	60	8,760	525,600	0.88	0.4	210,240	0.350	-0.142
Poolbeg 2	600,000	133,342	0.222	59.45	8,760	520,782	0.87	0.567	295,283	0.492	-0.270
Poolbeg 3	600,000	267,483	0.446	59.2	8,000	473,600	0.79	0.567	268,531	0.448	-0.002
IPCC 1996	1,000	557	0.557								
P1 Corrected	600,000	310,000	0.517						178,566	0.298	0.219
P2 Corrected	600,000	311715	0.520						178,566	0.298	0.222
P3 Corrected	600,000	320,259	0.533765	53.2	8,000	425,600	0.71	0.4	170240	0.284	0.250

		CO2 emitte	Electricity (	Net
Ringaskidd	418	-130	288	
Meath 2	305	-211	94	
Poolbeg 1	208	-350	-142	
Poolbeg 2	222	-492	-270	
Poolbeg 3	446	-448	-2	
IPCC 1996	557	0	0	
P1 Correct	517	-298	219	
P2 Correct	520	-298	222	
P3 Correct	534	-284	250	

Corrected	Poolbeg 2	was earlier	173,798

Carbon Fractions

	Poolbeg 1			Poolbeg 2							IPCC 2006			
Waste Type	**CCW**	**FCF**	**Waste Type**		**% Dry Matter Content**	**CCW**	**FCF**		**Diff CCW**	**Diff FCF**		**% Dry**	**CCW**	**FCF**
Paper / Card	33%	0%	Paper		90%	35.4%	0%		2.4%	0.0%	Paper/cardbo	90	46	1
Glass	0%	0%	Glass		100%	0.3%	0%		0.3%	0.0%	Glass	100	NA	NA
Plastics	61%	100%	Plastic		100%	51.3%	100%	9.7%	-9.7%	0.0%	Plastics	100	75	100
Metals	0%	0%	Ferrous		100%	0.0%	0%		0.0%	0.0%	Metal	100	NA	NA
			Aluminium		100%	0.0%	0%		0.0%	0.0%				
			Other Metals		100%	0.0%	0%		0.0%	0.0%				
Textiles	39%	50%	Textiles		80%	24.9%	50%	24.9%	-14.1%	0.0%	Textiles	80	50	20
Average Putrescibles	19%	0%	Organics		40%	35.8%	0.2%		16.8%	0.2%	Food waste	40	38	-
			WEEE		100%	0.0%	0%		0.0%	0.0%				
			Wood		85%	50.0%	0%		50.0%	0.0%	Wood	85	50	-
Others	24%	29%	Others		90%	11.0%	50%	11.0%	-13.1%	21.0%	Other, inert w	90	3	100
Total	29.0%	20.6%			72.9%	32.1%	22.3%							

as per IPCC 2006

	Bio	Fossil
Textiles	20%	19.93%
Others	9.86%	9.86%

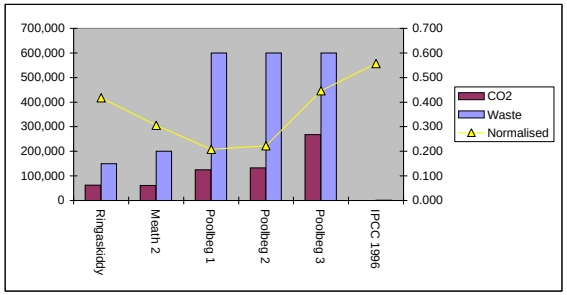


Table 2.4 Default dry matter content, DOC content, total carbon content and fossil carbon fraction of DIFFERENT MSW COMPONENTS									
MSW component	Dry matter content in % of wet weight[1]	DOC content in % of wet waste		DOC content in % of dry waste		Total carbon content in % of dry weight		Fossil carbon fraction in % of total carbon	
	Default	Default	Range	Default	Range [2]	Default	Range	Default	Range
Paper/cardboard	90	40	36-45	44	40-50	46	42-50	1	0-5
Glass[6]	100	-	-	-	-	NA	NA	NA	NA
Plastics	100	-	-	-	-	75	67-85	100	85 - 100
Metal[6]	100	-	-	-	-	NA	NA	NA	NA
Textiles [3]	80	24	20-40	30	25-50	50	25-50	20	0-50
Food waste	40	15	8-20	38	20-50	38	20-50	-	-
Wood	85 [4]	43	39-46	50	46-54	50	46-54	-	-
Garden and Park waste	40	20	18 -22	49	45-55	49	45-55	0	0
Nappies	40	24	18-32	60	54-90	70	54-90	10	10
Rubber and Leather	84	(39)[5]	(39)[5]	(47)[5]	(47)[5]	67	67	20	20
Other, inert waste	90	-	-	-	-	3	0-5	100	50 - 100

from IPCC 2006

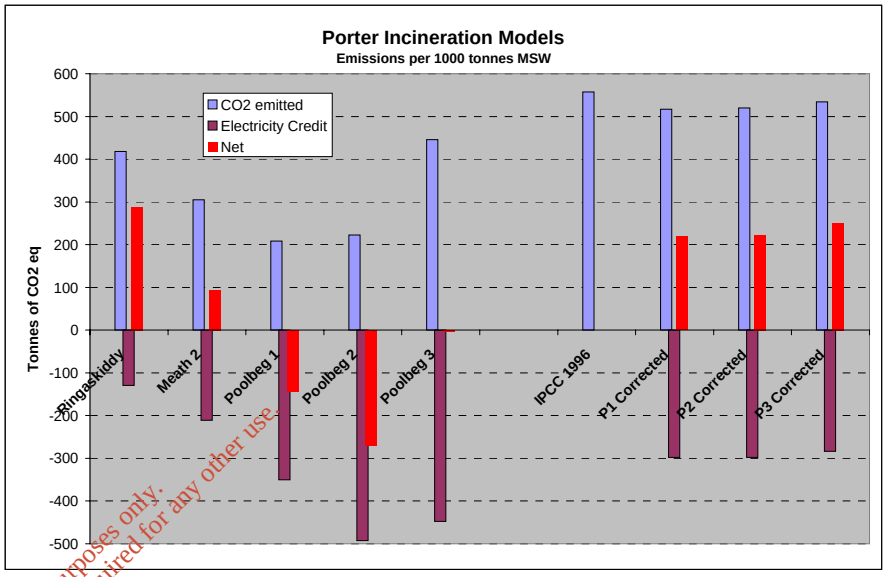


Table 15.3: Composition of Household and Commercial Waste Landfilled In Ireland In 1998[7]

Material	Household		Commercial		Total	
	(%)	(tonnes/annum)	(%)	(tonnes/annum)	(%)	(tonnes/annum)
Paper	19.5	219,573	58.6	328,277	32.5	547,849
Glass	5.5	61,526	3.4	19,232	4.8	80,757
Plastic	11.9	133,453	10.6	59,475	11.4	192,927
Ferrous	2	22,793	1	5,698	1.7	28,491
Aluminium	1	11,231	0.6	3,493	0.9	14,724
Other Metals	0.5	5,828	0.1	381	0.4	6,209
Textiles	2.9	32,708	0.6	3,434	2.1	36,142
Organics	32.9	370,542	15.1	84,662	27	455,204
Others	23.8	268,046	9.9	55,417	19.2	323,463
Total	100	1,125,698	100	560,068	100	1,685,766

Note: "Others" mainly refers to composites, fine elements such as ash, unclassified incombustibtes and unclassified combustibles including wood wastes.

(7) EPA National Waste Database Report 1998 (2000)

On page 3 of 18 Dr Porter states:

30% fossil origin
70% biogenic

On page 14 of 18 Dr Porter calculates:

In the current scenario for non-hazardous waste:

CO_2 emissions (tonnes/yr) = 150,000 x 0.40 x 0.30 x 0.95 x 44/12

CO_2 emissions = 62,700 tonnes/yr

Section 1.4 of page 4

The heat produced by the combustion process will be recovered and will generate approximately 10MW and 8MW of electricity in phases 1 and 2 respectively. In phase 1, up to 8MW of electricity is available for export to the National Grid, while in phase 2 up to 6MW will be available. The electricity produced by the waste-to-energy facility will be enough to supply the power needs of approximately 12,000 homes (phase 1) and 8,000 homes (phase 2) annually.

Section 3.7.1 page 12

Steam Turbine

In the proposed plant, the steam from the two boilers will be expanded in a single steam turbine down to a pressure of 0.15 bar gauge. This low pressure will maximise the energy recovery from the turbine, which will be used to drive the generator set (refer to Figure 3.16). It is estimated that the approximate electrical outputs will be as follows:

	Phase 1	Phase 2
Total	10MW	8MW
Plant Requirements	2MW	2MW
Net Available for Export	8MW	6MW

Table A1 : Default Data For Estimation of CO2 Emissions From Waste Incineration (6)

	MSW
C Content of Waste	33-50% default = 40%
Fossil Carbon as % of Total Carbon	30-50% default = 40%
Efficiency of Combustion	95-99% default = 95%

In the current scenario for non-hazardous waste:
CO2 emissions (tonneslyr) = 150,000 x 0.40 x 0.30 x 0.95 x 44112
CO2 emissions = 62,700 tonnes/yr
Where:

i = MSW
IWi = Amount of incinerated waste of type i (150,000 tonnes/annum)
CCWi = Fraction of carbon content in waste of type i {default = 0.40)
FCFi = Fraction of fossil carbon in waste of type i (maximum = 0.30)

EFi = Burn out efficiency of incinerators for waste of type i (default = 0.95)

In relation to the fraction of MWS waste of non-biogenic origin, this has been conservatively estimated based on the detailed breakdown of household and commercial waste currently landfilled in Ireland (see Table 15.3). The value of 0.30 should be compared with the USEPA data that typical USA mixed municipal solid waste (MSW) has about 10% non-biogenic carbon in MSW"'.

(6) IPCC Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories (1996)

	pa		over 25 years
Incineration	1.45E+05	25	3.63E+06
CCGT Avoid	4.54E+04		
Net Incin	9.96E+04	25	2.49E+06

	MW	Factor	Hours pa		
Porter	14	0.37	8760	45376.8	4.54E+04
Used 8760 again!					

Table 15.7: Greenhouse Gas Emissions at Indaver Ireland's Waste Management Facility, Ringaskiddy, Based on 200,000 Tonnes/Annum

	CO2	N2O	CH4	% Of Ireland's	Total Emissions(')	
Phase 1 & 2 / Annum (tonnes)(2)	1.45E+05	15	1.2			
Phase 1 & 2 / Annum (tonnes CO2 Equivalent)	1.45E+05	4650	25.2	0.21%		
Total Phase 1 & 2 (tonnes CO2 Equivalent) Over 25 Years	3.63E+06	1.16E+05	630			3.63E+06

1) Based on an approximate total emission 71.2 million tonnes CO2 equivalent in 2005 (based on estimates given in reference 11 for 2005)
(2) Based on Revised IPCC Guidelines as outlined in Appendix 15.2 and reference 6.
(3) Assuming, as a worst-case, that all organics are composed of methane.

Factors used by Porter in Ringaskiddy

Waste Mix											
CCW	30%	from his analysis (not stated) of EPA 1998 waste mix									
FCF	40%	from IPCC									
Quantity	150000	tonnes									
EF	0.95										
CO2 MW	3.67								71200000	Total for 2005	
yielding	62700	CO_2 emissions (tonnes/yr) = 150,000 x 0.40 x 0.30 x 0.95 x 44/12									
			CO2	N2O	CH4	N2Oeq	CH4eq	CO2eq	25 yr		
Non-hazardous		CO_2 emissions = 62,700 tonnes/yr	62700	4.5	0.4	1395	8.4	64103.4	1602585		
Hazardous		CO_2 emissions = 82,088 tonnes/yr	82088	10.5	0.8	3255	16.8	85359.8	2133995		
Combined			144788	15	1.2	4650	25.2	149463.2	3736580		
Energy produced			144788	4650	252			149690	3742250	0.21%	
Gross	8	MW									
internal plant use	2										
Export to grid	6	MW									
Hours	8760										
CCGT Factor	0.37										
yielding	19447	avoid									
		MW	Factor	Hours pa							
		14	0.37	8760	45376.8	CO2 avoided		0.064%			
Net incineration	43253				**99411.2**			0.14%	2.49E+06	3.50%	
									99600	0.14%	
Landfill									8.44E+05	1.19%	1.93E+06
									33760	0.05%	1.09E+06
											8.40E+05
Conclusion											

2.59E+06	Net Incin after power
2.15E+06	Less LF Haz exported
8.44E+05	Less LF local
-4.04E+05	Net benefit for Incin
25	
-16160	-0.023%

The waste to energy plant will emit approximately 160,000 tonnes per year of CO2 to atmosphere. For comparison, the total emissions of CO2 in Ireland during 1998 was 33,579,OOO tonnes with the energy sector contributing 15,047,OOO tonnes.

No model
No assumptions

Statement at EPA hearing

30%	anthropogenic
70%	inert or biogenic
11	MW
150,000	tonnes
of 2005 total	
0.04%	
0.05%	for landfill
0.01%	benefit of this facility

Table 15.3: Composition of Household and Commercial Waste Landfilled In Ireland In 2004[<7)]

Material	Household		Commercial		Total	
	(%)	(tonnes/annum)	(%)	(tonnes/annum)	(%)	(tonnes/annum)
Paper	19.20%	233,446	35.30%	212,860	24.50%	446,306
Glass	3.70%	45,313	1.50%	9,330	3.00%	54,643
Plastic	13.80%	167,261	12.00%	72,725	13.20%	239,986
Ferrous	1.50%	18,557	1.00%	5,892	1.30%	24,449
Aluminium	1.40%	16,795	0.60%	3,584	1.10%	20,379
Other Metals	0.40%	4,849	1.20%	7,381	0.70%	12,230
Textiles	11.00%	133,310	2.30%	13,676	8.10%	146,986
Organics	36.20%	440,131	37.60%	226,944	36.70%	667,075
WEEE	0.80%	9,179	0.40%	2,677	0.70%	11,856
Wood	0.90%	11,152	0.50%	3,027	0.80%	14,179
Others	11.10%	134,916	7.50%	45,516	9.90%	180,432
Total Fossil Fuel[(1)]	25.50%	309,750	14.80%	89,078	21.90%	398,828
Total Non-Fossil Fuel	74.50%	905,159	85.20%	514,534	78.10%	1,419,693
Total	100%	1,214,908	100%	603,628	100%	1,818,521

Note: "Others" mainly refers to composites, fine elements such as ash, unclassified incombustibles and unclassified combustibles including wood wastes.

(1) Derived from plastics, WEEE and textiles only and assumes that all WEEE and textiles are synthetic & carbon based (as a worst-case) leading to the fraction of fossil carbon of 0.219.

CO_2 emissions (tonnes/yr) = 200,000 x 0.40 x 0.219 x 0.95 x 44/12

CO_2 emissions = 61,028 tonnes/yr

42140 stated as saved on page 15-14 in Climate Chapter 15 of Indaver EIS

13 mw
0.37
8760
42135.6

So again Dr Porter uses 8760 hours!

From Poolbeg EIS Appendix 8.8

Table 8.3: Composition of Household and Commercial Waste Landfilled in Ireland In 2004(8)

Material	Household		Commercial		Total		Factor for fossil	Fossil Fraction		
	(%)	(tonnes/annum)	(%)	(tonnes/annum)	(%)	(tonnes/annum)				
Paper	19.2%	233,446	35.3%	212,860	24.5%	446,306				
Glass	3.7%	45,313	1.5%	9,330	3.0%	54,643				
Plastic	13.8%	167,261	12.0%	72,725	13.2%	239,986	100%	13.2%	239986	
Ferrous	1.5%	18,557	1.0%	5,892	1.3%	24,449				
Aluminium	1.4%	16,795	0.6%	3,584	1.1%	20,379				
Other Metals	0.4%	4,849	1.2%	7,381	0.7%	12,230				
Textiles	11.0%	133,310	2.3%	13,676	8.1%	146,986	50%	4.1%	73493	
Organics	36.2%	440,131	39.6%	226,944	36.7%	667,075				
WEEE	0.8%	9,179	0.4%	2,677	0.7%	11,856	100%	0.7%	11856	
Wood	0.9%	11,152	0.5%	3,027	0.8%	14,179				
Others	11.1%	134,916	9.5%	45,516	9.9%	180,432	29%	2.9%	52325	
Joe totals	100.0%	1,214,909	103.9%	603,612	100.0%	1,818,521				20.8%
Total Fossil Fuel[1]	23.2%	282,220	15.8%	95,440	20.6%	377,660			377,660	used in the analysis
Total Non-Fossil Fuel	76.8%	932,687	84.2%	508,188	79.4%	1,440,870			1,440,861	
Total	100%	1,214,908	100%	603,628	100%	1,818,530		0.20821		

Note: "Others" mainly refers to composites, fine elements such as ash, unclassified incombustibles and unclassified combustibles including wood wastes.

(1) Derived from plastics (100%), WEEE (100%) and textiles (50%) only and assumes that all WEEE and 50% of textiles are synthetic & carbon based leading to the fraction of fossil carbon of 0.206. Others is assumed to 29% fossil fuel[9].

Source for this table is 8
EPA National Waste Database Report 2004 (2006)

60
0.4
8760
210240

210240 stated in Table 8.6 of Appendix 8 - Poolbeg EIS

So again Dr Porter uses 8760 hours!

Incinerator Assumptions

600,000 tonnes
500,000 tonnes
400,000 tonnes
357,780 tonnes
300,000 tonnes

2005 Scenario

	household		commercial			Tonnage	Fossil Fraction	Waste Fraction	% Dry Matter Content	Total Carbon Content (Dry)	Fossil Carbon Fraction	600000 CO2 Emissions (Tonnes/Annum)	500000 CO2 Emissions (Tonnes/Annum)	400000 CO2 Emissions (Tonnes/Annum)	357780 CO2 Emissions (Tonnes/Annum)	300000 CO2 Emissions (Tonnes/Annum)	Tonnes MSW
Paper	19.20%	229,223	35.03%	220,734	24.7%	449,957		24.67%	90.0%	35.4%	0.0%						
Glass	3.70%	44,173	1.47%	9,288	2.9%	53,461		2.93%	100.0%	0.3%	0.0%						
Plastic	13.80%	164,754	12.17%	76,669	13.2%	241,423	100%	13.24%	100.0%	51.3%	100.0%	149375	124479	99583	89072	74688	
Ferrous	1.50%	17,908	1.00%	6,296	1.3%	24,204		1.33%	100.0%	0.0%	0.0%						
Aluminium	1.40%	16,714	0.57%	3,566	1.1%	20,280		1.11%	100.0%	0.0%	0.0%						
Other Metals	0.40%	4,775	1.23%	7,746	0.7%	12,521		0.69%	100.0%	0.0%	0.0%						
Textiles	11.00%	131,326	2.45%	15,464	8.0%	146,790	50%	8.05%	80.0%	24.9%	50.0%	17633	14695	11756	10515	8817	
Organics	36.20%	432,182	37.34%	235,331	36.6%	667,513		36.59%	40.0%	35.8%	0.2%	231	192	154	138	115	
WEEE	0.80%	9,551	0.44%	2,761	0.7%	12,312		0.67%	100.0%	0.0%	0.0%						
Wood	0.90%	10,745	0.51%	3,194	0.8%	13,939		0.76%	85.0%	50.0%	0.0%						
Others	11.10%	132,520	7.80%	49,145	10.0%	181,665	29%	9.96%	90.0%	11.0%	50.0%	10796	8997	7198	6438	5398	
Total Fossil Fuel					20.1%	367,501	20.15%										
Total Non-Fossil Fuel					79.9%	1,456,564											
Total	100%	1,193,871	100%	630,194	100.0%	1,824,065		100.00%	72.86%	32.12%	22.31%	178036	148363	118691	106163	89018	Tonnes CO2 /annum

Note Garden Waste 8.6%

Fossil Fraction ERM Impact of Energy from Waste (2006) - Closest to actual Irish Figures (Based on UK figure 2003 - 2005)
Total Carbon Have assumed figures are Wet as a worst case

% Dry Matter IPPC (2006) Table 2.4 Section 2, 2.14.

Calculation

CO_2 Emissions = MSW* SUM (Fraction of waste * dry matter content * fraction of carbon in dry matter* fraction of fossil carbon in total carbon* oxidation factor)*44/12

eg

Plastics = 600,000*0.1324*1.00*0.513*1.00*1.00*44/12 = 149,375 Tonnes per annum

Assumed 2020 Scenario 10% Paper & 10% Organic Waste Only

	household		commercial				Fossil Fraction	Waste Fraction	% Dry Matter Content	Total Carbon Content (Dry)	Fossil Carbon Fraction	CO2 Emissions (Tonnes/Annum)	500000 CO2 Emissions (Tonnes/Annum)	400000 CO2 Emissions (Tonnes/Annum)	357780 CO2 Emissions (Tonnes/Annum)	300000 CO2 Emissions (Tonnes/Annum)	Tonnes MSW
Paper	19.20%	229,223	35.03%	220,734	24.7%	449,957		10.00%	90.0%	35.4%	0.0%						
Glass	3.70%	44,173	1.47%	9,288	2.9%	53,461		6.06%	100.0%	0.3%	0.0%						
Plastic	13.80%	164,754	12.17%	76,669	13.2%	241,423	100%	27.35%	100.0%	51.3%	100.0%	308626	257189	205751	184034	154313	
Ferrous	1.50%	17,908	1.00%	6,296	1.3%	24,204		2.74%	100.0%	0.0%	0.0%						
Aluminium	1.40%	16,714	0.57%	3,566	1.1%	20,280		2.30%	100.0%	0.0%	0.0%						
Other Metals	0.40%	4,775	1.23%	7,746	0.7%	12,521		1.42%	100.0%	0.0%	0.0%						
Textiles	11.00%	131,326	2.45%	15,464	8.0%	146,790	50%	16.63%	80.0%	24.9%	50.0%	36433	30361	24289	21725	18216	
Organics	36.20%	432,182	37.34%	235,331	36.6%	667,513		10.00%	40.0%	131.1%	0.2%	231	192	154	138	115	
WEEE	0.80%	9,551	0.44%	2,761	0.7%	12,312		1.39%	100.0%	0.0%	0.0%						
Wood	0.90%	10,745	0.51%	3,194	0.8%	13,939		1.58%	85.0%	50.0%	0.0%						
Others	11.10%	132,520	7.80%	49,145	10.0%	181,665	29%	20.58%	90.0%	11.0%	50.0%	22307	18589	14871	13301	11153	
Total Fossil Fuel					80.0%	0	41.63%										
Total Non-Fossil Fuel					0.0%	0											
Total	100%	1,193,871	100%	630,194	100.0%	1,824,065		100.04%	81.42%	37.88%	45.97%	367597	306331	245064	219198	183798	Tonnes CO2 /annum

Note Garden Waste Assumed 8.6%

	Food	Garden	Paper	Wood	Textile	Nappies	Plastics, other inert
2012	25.0%	8.6%	24.7%	0.8%	8.1%	3.0%	29.9%
2013	22.9%	7.8%	22.8%	0.9%	9.1%	3.0%	33.6%
2014	20.7%	7.0%	21.0%	1.0%	10.2%	3.0%	37.2%
2015	18.6%	6.2%	19.2%	1.1%	11.2%	3.0%	40.8%
2016	16.4%	5.4%	17.3%	1.2%	12.3%	3.0%	44.5%
2017	14.3%	4.6%	15.5%	1.3%	13.4%	3.0%	48.1%
2018	12.1%	3.8%	13.6%	1.4%	14.4%	3.0%	51.8%
2019	10.0%	3.0%	11.8%	1.5%	15.5%	3.0%	55.4%
2020	7.6%	2.4%	10.0%	1.6%	16.6%	3.0%	59.0%

2005 National Waste Report Including 80,000 tonnes of sludge

	household		commercial				Fossil Fraction	Waste Fraction	% Dry Matter Content	Total Carbon Content (Dry)	Fossil Carbon Fraction	600000 CO2 Emissions (Tonnes/Annum)	500000 CO2 Emissions (Tonnes/Annum)	400000 CO2 Emissions (Tonnes/Annum)	357780 CO2 Emissions (Tonnes/Annum)	300000 CO2 Emissions (Tonnes/Annum)	Tonnes MSW
Paper	19.20%	229,223	35.03%	220,734	24.7%	449,957		21.38%	90.0%	35.4%	0.0%						
Glass	3.70%	44,173	1.47%	9,288	2.9%	53,461		2.54%	100.0%	0.3%	0.0%						
Plastic	13.80%	164,754	12.17%	76,669	13.2%	241,423	100%	11.47%	100.0%	51.3%	100.0%	129458	107882	86306	77196	64729	
Ferrous	1.50%	17,908	1.00%	6,296	1.3%	24,204		1.15%	100.0%	0.0%	0.0%						
Aluminium	1.40%	16,714	0.57%	3,566	1.1%	20,280		0.96%	100.0%	0.0%	0.0%						
Other Metals	0.40%	4,775	1.23%	7,746	0.7%	12,521		0.59%	100.0%	0.0%	0.0%						
Textiles	11.00%	131,326	2.45%	15,464	8.0%	146,790	50%	6.97%	80.0%	24.9%	50.0%	15282	12735	10188	9113	7641	
Organics	36.20%	432,182	37.34%	235,331	36.6%	667,513		31.72%	40.0%	41.3%	0.2%	231	192	154	138	115	
WEEE	0.80%	9,551	0.44%	2,761	0.7%	12,312		0.58%	100.0%	0.0%	0.0%						
Wood	0.90%	10,745	0.51%	3,194	0.8%	13,939		0.66%	85.0%	50.0%	0.0%						
Others	11.10%	132,520	7.80%	49,145	10.0%	181,665	29%	8.63%	90.0%	11.0%	50.0%	9357	7797	6238	5580	4678	
Sludge						80,000	17.46%	13.33%	10.0%	50.0%	0.0%						
Total Fossil Fuel					20.1%	367,501											
Total Non-Fossil Fuel					79.9%	1,456,564											
Total	100%	1,193,871	100%	630,194	100.0%	1,824,065		100.00%	63.14%	29.59%	19.34%	154329	128607	102886	92026	77164	Tonnes CO2 /annum

Note Garden Waste 8.6%

Incinerator Result Summary

Maximum Continuous Rating

	Annual capacity t/y	LHV GJ/t	MCR hours h per year	Thermal input MW	Net Power eff %	NetPower output Mwe	District Heating Mwe
	600,000	10.5	8,537	205	29.0%	59.5	80
	550,000	10.5	8,537	188	28.5%	53.6	
	500,000	10.5	8,537	171	28.0%	47.8	
	450,000	10.5	8,537	154	27.5%	42.3	
	400,000	10.5	8,537	137	27.0%	36.9	
	357,780	10.5	8,537	122	26.5%	32.4	
	300,000	10.5	8,537	103	26.0%	26.7	
Sludge	520000						
Option	80000	wet					
	8000	dry					

Tonnage: Tonnes / hour 70.3

		Current		Landfill Directive
	Fraction of carbon content	32.12%	IPCC 2006	37.88%
	Fraction of fossil carbon	22.31%	IPCC 2006	45.97%
	N20 Emission Factor	0.004	tonnes/GJ	0.004
	CH4 Emission Factor	0.03	tonnes/GJ	0.03
	CH4 EF Sludge	0.0097	kg/tonne (wet)	
	N2O EF Sludge	0.9	kg/tonne (dry)	
was .567	Fuel Mix CO2 Emission Factor	0.4	2012 Value	0.567
	CCGT N20 Emission Factor	0.0001	tonnes/GJ	0.0001
	CCGT CH4 Emission Factor	0.001	tonnes/GJ	0.001

Poolbeg 2 / **Claus Norgaard**

365	24	8760	hours in the year
		8537	Rated MCR hours
		408	downtime is 17 days pa
		8352	actual hours
		205	Boiler Input power MW
		29%	efficiency
		59.45	Max electrical power at MCR
Porter used full 60 MW		6	Minus MW for internal consumption
		53.45	Electricty MW exported to grid
Porter used 520,782 MWh		446,414	MWhours exported
Porter used 0.567 for CCGT		0.4	CCGT factor
		178,566	Tonnes CO2 avoided
		0.6	N2O
		6.3	CH4
Porter result was 295,283 tonnes CO2 avoided		178,573	GHG tonnes avoided
		116,710	**Difference**

	Capacity	CO_2 Emissions		N2O Emissions		CH4 Emissions		Total		Total 30 Years	
Current	600,000	234710	tonnes	25.2	tonnes	6.3	tonnes	242655	Ton CO2Eq	7.28E+06	Ton CO2Eq
Biogenics	500,000	195592	tonnes	23.1	tonnes	5.8	tonnes	202874	Ton CO2Eq	6.09E+06	Ton CO2Eq
	400,000	156473	tonnes	21.0	tonnes	5.3	tonnes	163094	Ton CO2Eq	4.89E+06	Ton CO2Eq
	357,780	139958	tonnes	18.9	tonnes	4.7	tonnes	145916	Ton CO2Eq	4.38E+06	Ton CO2Eq
	300,000	117355	tonnes	16.8	tonnes	4.2	tonnes	122651	Ton CO2Eq	3.68E+06	Ton CO2Eq
Low Biogenics	600,000	367597	tonnes	25.2	tonnes	6.3	tonnes	375541	Ton CO2Eq	1.13E+07	Ton CO2Eq
Sludge 80,000	600,000	154329	tonnes	29.0	tonnes	6.2	tonnes	163462	Ton CO2Eq	4.90E+06	Ton CO2Eq

GHG Savings In 2005 Terms

		CO_2 Emissions		N2O Emissions		CH4 Emissions		Total		Total 30 Years	
was =G6*8760*D22	600,000	178,566	tonnes	0.6	tonnes	6.3	tonnes	178893	Ton CO2Eq	5.37E+06	Ton CO2Eq
	500,000	139,757	tonnes	0.6	tonnes	5.8	tonnes	140057	Ton CO2Eq	4.20E+06	Ton CO2Eq
	400,000	103,231	tonnes	0.5	tonnes	5.3	tonnes	103504	Ton CO2Eq	3.11E+06	Ton CO2Eq
	357,780	88,177	tonnes	0.5	tonnes	4.7	tonnes	88423	Ton CO2Eq	2.65E+06	Ton CO2Eq
	300,000	68,988	tonnes	0.4	tonnes	4.2	tonnes	69206	Ton CO2Eq	2.08E+06	Ton CO2Eq
District Heating	600,000	267,264	tonnes	0.6	tonnes	6.3	tonnes	267592	Ton CO2Eq		

Overall GHG Emissions

Capacity	Total		Total 30 Years	
600,000	63761	Ton CO2Eq	1.91E+06	Ton CO2Eq
500,000	62817	Ton CO2Eq	1.88E+06	Ton CO2Eq
400,000	59590	Ton CO2Eq	1.79E+06	Ton CO2Eq
357,780	57493	Ton CO2Eq	1.72E+06	Ton CO2Eq
300,000	53445	Ton CO2Eq	1.60E+06	Ton CO2Eq

	Per annum One line	Both	Overall
1. Scheduled maintenance of 3 weeks every 18 months	14		
2. Common outages of 3 days per line per annum		3	17
4. Turbine maintenance is 2-3 weeks every five years			overlapped
5. Each line contributes half the energy used by the turbine			
			15
			365
			4.1%
			4.1%

? Where is the Sludge comparison ? Joe

8760

60

525,600
0.4
210,240

31,674
Delta

Comparitive electrical efficiencies

BAT in the Poolbeg EIS

5.1.79. The Facility will as an annual average generate in excess of 0.65 MWh electricity/tonne waste received (BAT62)63. The Facility has however been designed with built-in provisions for steam/district heating supply. If the steam/district heating option are implemented the electricity/tonne waste received will decrease slightly.

5.1.80. The installation electrical demand (excluding pre-treatment or residue treatment) will generally be below 0.15 MWh/tonne of waste processed as an annual average (BAT63) 64.

0.65	MWh/tonne	600000	390000
0.15		600000	90000
	for		8537 hours
			45.7 MW electricity output
			10.5 MW electricity internal
			35.1 Net electricoty to export

550000	
60	
9166.667	

Limerick Clare Kerry Feasibility Study
RPS-MCOS
Section 4.2

The energy recovery efficiency from excess air thermal treatment plants will vary both with plant design and with the type of energy cycle used, but power generating efficiencies are lower than for large utility power stations. A thermal treatment plant with a fully condensing turbine cycle may achieve a gross electric efficiency of approximately 30%. In the case of combined heat and power production the electricity generation is typically 20-25% gross, but an additional 50-60% will be recovered as useful thermal energy. In-house electricity consumption is in both cases typically 10-15% of the gross electricity production.

6.2.1 Electricity

The maximum electrical output from a thermal waste treatment plant is of the order of 500-600kWh per tonne of MSW treated and the corresponding net power output from such a facility will be in the region of 5-8MW per 100,000 tonnes per annum capacity. Plants differ in efficiency and typically some 5-10% of gross output will be consumed internally. Access to a source of cooling water has a significant effect on overall plant efficiency as the alternative will be to install air cooling equipment which consumes greater internal power.

Tonne Km Analysis

Breakdown between public waste and private waste 320,000 & 280,000

km						tonnes	tonne kms
17		444000	Kilshane Cross	12%		53,280	905,760
30			Ballymount	64%		284,160	8,524,800
44			Ballyogan	24%		106,560	4,688,640
5	Direct	50	10	500	26.0%	156250	781,250
	Transfer	71	20	1420	74.0%	443750	
				1920	tonnes per day		
				600,000	pa		

Table 2.4 Default dry matter content, DOC content, total carbon content and fossil carbon fraction of DIFFERENT MSW COMPONENTS

MSW component	Dry matter content in % of wet weight[1]	DOC content in % of wet waste		DOC content in % of dry waste		Total carbon content in % of dry weight		Fossil carbon fraction in % of total carbon	
	Default	Default	Range	Default	Range [2]	Default	Range	Default	Range
Paper/cardboard	90	40	36-45	44	40-50	46	42-50	1	0-5
Textiles [3]	80	24	20-40	30	25-50	50	25-50	20	0-50
Food waste	40	15	8-20	38	20-50	38	20-50	-	-
Wood	85 [4]	43	39-46	50	46-54	50	46-54	-	-
Garden and Park waste	40	20	18 -22	49	45-55	49	45-55	0	0
Nappies	40	24	18-32	60	54-90	70	54-90	10	10
Rubber and Leather	84	(39)[5]	(39)[5]	(47)[5]	(47)[5]	67	67	20	20
Plastics	100	-	-	-	-	75	67-85	100	85 - 100
Metal[6]	100	-	-	-	-	NA	NA	NA	NA
Glass[6]	100	-	-	-	-	NA	NA	NA	NA
Other, inert waste	90	-	-	-	-	3	0-5	100	50 - 100

Default values for DOC and fossil carbon content in different waste types is given in Table 2.4. Table 2.4 gives default values also for garden and park waste, and disposable nappies. These waste types were not included in Table 2.3 due to lack of data. All fractions in the Table 2.4 are given as percentages.

[1] The moisture content given here applies to the specific waste types before they enter the collection and treatment. In samples taken from collected waste or from e.g., SWDS the moisture content of each waste type will vary by moisture of co-existing waste and weather during handling.

[1] The range refers to the minimum and maximum data reported by Dehoust *et al.,* 2002; Gangdonggu, 1997; Guendehou, 2004; JESC, 2001; Jager and Blok, 1993; Würdinger *et al.,* 1997; and Zeschmar-Lahl, 2002.

[3] 40 percent of textile are assumed to be synthetic (default). Expert judgement by the authors.

[4] This value is for wood products at the end of life. Typical dry matter content of wood at the time of harvest (that is for garden and park waste) is 40 percent. Expert judgement by the authors.

[5] Natural rubbers would likely not degrade under anaerobic condition at SWDS (Tsuchii et al., 1985; Rose and Steinbüchel, 2005).

[6] Metal and glass contain some carbon of fossil origin. Combustion of significant amounts of glass or metal is not common.

DOC values for different waste types, which are derived from analyses based on sampling during waste collection at SWDS or at incineration facilities, may include impurities, e.g., traces of food in glass and plastic waste. Carbon contents of paper, textiles, nappies, rubber and plastic may also be different between countries and at different time periods. These analyses may therefore result in DOC estimates different from those given in Table 2.4. It is *good practice* to use DOC values consistently with the way the waste composition data are derived.

The best composition data can be obtained by routine monitoring at the gate of SWDS or incineration and other treatment facilities. If these data are not available, composition data obtained at generation and/or transportation, treatment and recycling facilities can be used for disposed DOC estimations using waste stream analysis (see Box 2.1).

Waste can be sampled at pits in waste treatment facilities, at loading yards in transportation stations and SWDS. Composition data of disposed waste can be obtained from field sampling at SWDS. The amount of waste (typically more than 1 m^3 for a representative sample) should be separated manually into each item and weighed by item in order to obtain wet weight composition. A certain amount of each item should be reduced and sampled by quartering and used for chemical analysis including moisture and DOC. Samples should be taken on different days of the week.

MSW composition will vary by city in a same country. It will also vary by the day of the week, season and year in the same city. National representative (or average) composition data should be obtained from sampling at several typical cities on same days of the week in each season. Sampling at SWDS on rainy days will change moisture content (i.e., wet weight composition) significantly, and needs attention in interpretation of that in annual data.

As published

Waste Type	Composition of Waste (Ireland 2004)[8]	Carbon Content %C	% Fossil Carbon	Fossil CO_2 kg/t	N_2O kg/t							
								3.67				
Paper / Card	24.5%	33%	0%	0	0.05			Fossil C	Fossil CO2			
Average Putrescibles	36.7%	19%	0%	0	0.05							
Plastics	13.2%	61%	100%	2237	0.05	13.200%	61.0%	610				
Glass	3.0%	0%	0%	0	0.05							
Metals	3.1%	0%	0%	0	0.05							
Textiles	8.1%	39%	50%	715	0.05	4.050%	19.5%	195				
Others	11.4%	24%	29%	255	0.05	3.306%	7.0%	70				
Total		29.0%	0.206%			20.556%		875	3207			

Table A8.2: Incineration Treatment Emissions[9] 0.29 0.206 0.95 3.667 0.208094

In the current scenario:

CO_2 emissions (tonnes/yr) = Σ_I(IWi x CCWix FCFi x EFi x 44/12)

CO_2 emissions (tonnes/yr) = 600,000 x 0.29 x 0.206 x 0.95 x 44/12

CO_2 emissions = 124,857 tonnes/yr

Where:

i	=	MSW
IWi	=	Amount of incinerated waste of type i (600,000 tonnes/annum)
CCWi	=	Fraction of carbon content in waste of type i (national average = 0.29)
FCFi	=	Fraction of fossil carbon in waste of type i (national average = 0.206)
EFi	=	Burn out efficiency of combustion of incinerators (default = 0.95)

In relation to the fraction of waste of non-biogenic origin, this has been estimated based on the detailed breakdown of household and commercial waste currently landfilled in Ireland in 2004 (see Table 8.3).

NO Emissions

The calculation of N_2O emissions is based on waste input to the incinerators and an emission factor:

N_2O emissions (Gg/yr) = Σ_I(IWi x EFi) X 10^{-6}

Where:

IWi	=	Amount of incinerated waste of type i (Gg/yr)
EFi	=	Aggregate N_2O emission factor for waste of type i (kg N_2O/Gg)

The above percentages are taken directly from the EU 2001 report

Impact of Energy from Waste and Recycling Policy on UK Greenhouse Gas Emissions
Defra Final Report January 2006 www.erm.com

Page D1 of ERM DEFRA report

WASTE FRACTION PROPERTY ASSUMPTIONS
Key assumptions regarding the calorific value and carbon content of the waste fractions modelled are detailed in Table 1.1 and Table 1.2. These have a direct influence on emissions estimates and energy recovery values for the alternative waste treatment processes modelled.

Table 1.1 Waste Fraction Calorific Values

Waste Fraction	*Net Calorific Value (MJ/kg)*
Paper & Card	11.00
Kitchen Waste	3.59
Green Waste	3.59
Textiles	14.33
Fines	3.48
Ferrous Metal	0.00
Non-ferrous Metal	0.00
Glass	1.42
Plastic (dense)	24.86
Plastic (film)	21.28
Miscellaneous Combustibles	14.06
Miscellaneous Non-combustibles	2.57

Source: ERM & Environment Agency Data (2003-2005)

Table 1.2 Waste Fraction Carbon Content

Waste Fraction	*Biogenic Carbon Content (%)*	*Fossil Carbon Content (%)*	combine	average	% dry matter		**Used by AWN**	
Paper & Card	31.87				90%	35.4	35.4	same
Kitchen Waste	13.46		30.63	15.32	40%	38.3	35.8	different
Green Waste	17.17							
Textiles1	19.93	19.93			80%	24.9	24.9	same
Fines1	6.88	6.88						
Ferrous Metal	0.00							
Non-ferrous Metal	0.00							
Glass	0.28							
Plastic (dense)	Located in error under "biogenic"	54.83	102.64	51.3	100%	51.3	51.3	same
Plastic (film)		47.81						
Miscellaneous Combustibles1	19.20	19.20	22.70	11.4	90%	10.2	11.0	different
Miscellaneous Noncombustibles1	3.50	3.50						
							?	

Source: ERM & Environment Agency Data (2003-2005)

Notes:
1. Assumed to comprise 50% biogenic carbon content and 50% fossil carbon content

Wood			50.0
Joe averaging "Others"	9.86	9.86	

From Page 11 in same report Much different to the Irish composition
MSW Waste Composition
Waste Fraction % Composition in MSW % Biodegradability
Paper/Card 21.0% 100%
Kitchen Waste* 17.8% 100%
Garden Waste 12.7% 100%
Textiles 1.8% 50%
Fines 5.2% 50%
Miscellaneous. Combustible 12.1% 50%
Other, Miscellaneous Wastes** 10.8% 35%
Ferrous Metals 4.7% 0%
Non-Ferrous Metals 0.8% 0%
Glass 5.8% 0%
Plastic Dense 4.5% 0%
Plastic Film 2.8% 0%
Total 100.0 65%
* includes 'other' organics (2.1%)
** includes WEEE (2%) and Specific Hazardous Household Waste Items (including all batteries)
-0.81%

Baseline data for waste composition have been taken and adapted from: The Composition of Municipal Waste in Wales. National Assembly for Wales (NAW)/AEAT Technology - December 2003. The proportion of biodegradable material in each waste fraction has been estimated by ERM. Assumed average MSW composition and biodegradable content is shown in Table 3.1.

From EU Report Waste management options and climate change 2001

Table A3.35: Incineration treatment emissions

Component	Carbon content %C	% fossil carbon	fossil CO_2 kg/t	N_2O kg/t
	a	b	c=a*b*44000/12	
Paper/Card	33%	0%	0	0.05
Putrescible	19%	0%	0	0.05
Plastic	61%	100%	2237	0.05
Glass*	0	0%	0	0.05
Metals	0	100%	0	0.05
Textiles	39%	50%	718	0.05
Other**	24%	29%	256	0.05

**The chemical analysis of dustbin waste shows a small amount of carbon associated with glass and metal as food remnants and paper labels on cans and bottles, but this has been omitted for simplicity

**The 'Other' category is a weighted average of the three UK categories of 'fines', 'miscellaneous combustibles' and 'miscellaneous non-

Others: Includes cooking oil, mineral oil, batteries, composite packaging, tyres and 70,139 tonnes of residues from mechanical treatment of mixed municipal waste shipped to Germany and Northern Ireland for recovery and recycling respectively.

from EPA report page 9

My estimate for Fossil Carbon fraction for "Other" is 75%

Porter Assumptions

Plant	Year	Throughput	CCW	FCF	CO_2	Assumption	N2O	CH4	MW	Contrib Plant	Alternative	Net
Ringaskiddy	2001	150,000	40%	30%	62,700	30 kg / Gg	4.5	?	8			
Meath 1	2005	150,000							11	0.04%	0.05%	0.01%
Meath 2	2006	200,000	40%	21.9%	61,028	30 kg / Gg	6		13	0.03%	0.042%	0.012%
Poolbeg 1	2006	600,000	29%	20.6%	124,857	30 kg / Gg	6		60			
Poolbeg 2	2007	600,000	29%	22.0%	124,857	30 kg / Gg	6		60			
Poolbeg Sludge	2007	600,000	32%	22.3%	178,036	30 kg / Gg	6		60			
IPCC 1996		1000	40%	40.0%								

Joe check

CO2 emissions (tonnes/yr) = Σi(IWi x CCWi x FCFi x EFi x 44/12)

				N2O
95%	3.667	62,700	30	4.5
95%	3.667	61,028	30	6
95%	3.667	124,857	50	30
95%	3.667	133,342	50	30
95%	3.667	149,608	50	30
95%	3.667	557		

Ringaskiddy	62,700	150,000
Meath 2	61,028	200,000
Poolbeg 1	124,857	600,000
Poolbeg 2	133,342	600,000
IPCC 1996	557	1,000

Incinerator Assumptions

Annual capacity	LHV	MCR hours	Thermal input	Net Power eff	NetPower output
t/y	GJ/t	h	MW	%	Mwe
600000	10.5	8537	205	**0.29**	**59.45**
550000	10.5	8537	188	0.285	53.56
500000	10.5	8537	171	0.28	47.83
450000	10.5	8537	154	0.275	42.28
400000	10.5	8537	137	0.27	36.90
357780	10.5	8537	122	0.265	32.39
300000	10.5	8537	103	0.26	26.65

Sludge	520000	
Option	80000	wet
	8000	dry

	Current		Landfill Directive	Data Source
Fraction of carbon content	0.321	IPCC 2006	0.379	National Waste Breakdown 2005 & IPPC Default carbon fractions
Fraction of fossil carbon	0.223	IPCC 2006	0.460	National Waste Breakdown 2005 & IPPC Default carbon fractions
N20 Emission Factor	0.004	tonnes/GJ	0.004	IPCC Volume 2 Chapter 2 Stationary Sources Table 2.2
CH4 Emission Factor	0.03	tonnes/GJ	0.03	IPCC Volume 2 Chapter 2 Stationary Sources Table 2.2
CH4 EF Sludge	0.0097	kg/tonne (wet)		Sludge Data (Japan) IPCC Vol.5 5.20
N2O EF Sludge	0.9	kg/tonne (dry)		IPCC Vol.5 5.21 German data (Dry) Japan data - wet but uses dehydrated sludge
Fuel Mix CO2 Emission Factor	0.567	2012 Value	0.567	Based on data for 2005 in SEI (2006) and assuming 17% Renewables by 2012
CCGT N20 Emission Factor	0.0001	tonnes/GJ	0.0001	IPCC Volume 2 Chapter 2 Stationary Sources Table 2.2
CCGT CH4 Emission Factor	0.001	tonnes/GJ	0.001	IPCC Volume 2 Chapter 2 Stationary Sources Table 2.2

Calculation

CO_2 Emissions = MSW* SUM (Fraction of waste * dry matter content * fraction of carbon in dry matter* fraction of fossil carbon in total carbon* oxidation factor)*44/12

eg

Plastics = 600,000*0.1324*1.00*0.513*1.00*1.00*44/12 = 149,375 Tonnes per annum

Energy Savings Due To Export To Grid

MW Export To Grid * Hours of Operation * Replacement GHG Emissions kg CO2 / MWh

MW = 59.5
Hours of Operation = 8537
Default Fuel Mix CO2 Emission Factor = 0.567 kgCO2 Equiv / MWh

Energy Savings =59.45*8760*0.567 = 295283 tonnes / annum

Overall GHG Emissions

Capacity	Total	
600000	**GHG Emissions - Energy Savings**	**Ton CO2Eq**

Incinerator Assumptions

600,000 tonnes
500,000 tonnes
400,000 tonnes
357,780 tonnes
300,000 tonnes

2005 Scenario

	household		commercial			Tonnage	Fossil Fraction	Waste Fraction	% Dry Matter Content	Total Carbon Content (Dry)	Fossil Carbon Fraction	600000 CO2 Emissions (Tonnes/Annum)	500000 CO2 Emissions (Tonnes/Annum)	400000 CO2 Emissions (Tonnes/Annum)	357780 CO2 Emissions (Tonnes/Annum)	300000 CO2 Emissions (Tonnes/Annum)	Tonnes MSW
Paper	19.20%	229,223	35.03%	220,734	24.7%	449,957		24.67%	90.0%	35.4%	0.0%						
Glass	3.70%	44,173	1.47%	9,288	2.9%	53,461		2.93%	100.0%	0.3%	0.0%						
Plastic	13.80%	164,754	12.17%	76,669	13.2%	241,423	100%	13.24%	100.0%	51.3%	100.0%	149375	124479	99583	89072	74688	
Ferrous	1.50%	17,908	1.00%	6,296	1.3%	24,204		1.33%	100.0%	0.0%	0.0%						
Aluminium	1.40%	16,714	0.57%	3,566	1.1%	20,280		1.11%	100.0%	0.0%	0.0%						
Other Metals	0.40%	4,775	1.23%	7,746	0.7%	12,521		0.69%	100.0%	0.0%	0.0%						
Textiles	11.00%	131,326	2.45%	15,464	8.0%	146,790	50%	8.05%	80.0%	24.9%	50.0%	17633	14695	11756	10515	8817	
Organics	36.20%	432,182	37.34%	235,331	36.6%	667,513		36.59%	40.0%	35.8%	0.2%	231	192	154	138	115	
WEEE	0.80%	9,551	0.44%	2,761	0.7%	12,312		0.67%	100.0%	0.0%	0.0%						
Wood	0.90%	10,745	0.51%	3,194	0.8%	13,939		0.76%	85.0%	50.0%	0.0%						
Others	11.10%	132,520	7.80%	49,145	10.0%	181,665	29%	9.96%	90.0%	11.0%	50.0%	10796	8997	7198	6438	5398	
Total Fossil Fuel					20.1%	367,501	20.15%										
Total Non-Fossil Fuel					79.9%	1,456,564											
Total	100%	1,193,871	100%	630,194	100.0%	1,824,065		100.00%	72.86%	32.12%	22.31%	178036	148363	118691	106163	89018	Tonnes CO2 /annum

Note Garden Waste 8.6%

Fossil Fraction ERM Impact of Energy from Waste (2006) - Closest to actual Irish Figures (Based on UK figure 2003 - 2005)
Total Carbon Have assumed figures are Wet as a worst case
% Dry Matter IPPC (2006) Table 2.4 Section 2, 2.14.

Calculation

CO_2 Emissions = MSW* SUM (Fraction of waste * dry matter content * fraction of carbon in dry matter* fraction of fossil carbon in total carbon* oxidation factor)*44/12

eg

Plastics = 600,000*0.1324*1.00*0.513*1.00*1.00*44/12 = 149,375 Tonnes per annum

Assumed 2020 Scenario — 10% Paper & 10% Organic Waste Only

	household		commercial				Fossil Fraction	Waste Fraction	% Dry Matter Content	Total Carbon Content (Dry)	Fossil Carbon Fraction	CO2 Emissions (Tonnes/Annum)	500000 CO2 Emissions (Tonnes/Annum)	400000 CO2 Emissions (Tonnes/Annum)	357780 CO2 Emissions (Tonnes/Annum)	300000 CO2 Emissions (Tonnes/Annum)	Tonnes MSW
Paper	19.20%	229,223	35.03%	220,734	24.7%	449,957		10.00%	90.0%	35.4%	0.0%						
Glass	3.70%	44,173	1.47%	9,288	2.9%	53,461		6.06%	100.0%	0.3%	0.0%						
Plastic	13.80%	164,754	12.17%	76,669	13.2%	241,423	100%	27.35%	100.0%	51.3%	100.0%	308626	257189	205751	184034	154313	
Ferrous	1.50%	17,908	1.00%	6,296	1.3%	24,204		2.74%	100.0%	0.0%	0.0%						
Aluminium	1.40%	16,714	0.57%	3,566	1.1%	20,280		2.30%	100.0%	0.0%	0.0%						
Other Metals	0.40%	4,775	1.23%	7,746	0.7%	12,521		1.42%	100.0%	0.0%	0.0%						
Textiles	11.00%	131,326	2.45%	15,464	8.0%	146,790	50%	16.63%	80.0%	24.9%	50.0%	36433	30361	24289	21725	18216	
Organics	36.20%	432,182	37.34%	235,331	36.6%	667,513		10.00%	40.0%	131.1%	0.2%	231	192	154	138	115	
WEEE	0.80%	9,551	0.44%	2,761	0.7%	12,312		1.39%	100.0%	0.0%	0.0%						
Wood	0.90%	10,745	0.51%	3,194	0.8%	13,939		1.58%	85.0%	50.0%	0.0%						
Others	11.10%	132,520	7.80%	49,145	10.0%	181,665	29%	20.58%	90.0%	11.0%	50.0%	22307	18589	14871	13301	11153	
Total Fossil Fuel					80.0%	0	41.63%										
Total Non-Fossil Fuel					0.0%	0											
Total	100%	1,193,871	100%	630,194	100.0%	1,824,065		100.04%	87.42%	37.88%	45.97%	367597	306331	245064	219198	183798	Tonnes CO2 /annum

Note Garden Waste Assumed 8.6%

	Food	Garden	Paper	Wood	Textile	Nappies	Plastics, other inert
2012	25.0%	8.6%	24.7%	0.8%	8.1%	3.0%	29.9%
2013	22.9%	7.8%	22.8%	0.9%	9.1%	3.0%	33.6%
2014	20.7%	7.0%	21.0%	1.0%	10.2%	3.0%	37.2%
2015	18.6%	6.2%	19.2%	1.1%	11.2%	3.0%	40.8%
2016	16.4%	5.4%	17.3%	1.2%	12.3%	3.0%	44.5%
2017	14.3%	4.6%	15.5%	1.3%	13.4%	3.0%	48.1%
2018	12.1%	3.8%	13.6%	1.4%	14.4%	3.0%	51.8%
2019	10.0%	3.0%	11.8%	1.5%	15.5%	3.0%	55.4%
2020	7.6%	2.4%	10.0%	1.6%	16.6%	3.0%	59.0%

2005 National Waste Report Including 80,000 tonnes of sludge

	household		commercial				Fossil Fraction	Waste Fraction	% Dry Matter Content	Total Carbon Content (Dry)	Fossil Carbon Fraction	600000 CO2 Emissions (Tonnes/Annum)	500000 CO2 Emissions (Tonnes/Annum)	400000 CO2 Emissions (Tonnes/Annum)	357780 CO2 Emissions (Tonnes/Annum)	300000 CO2 Emissions (Tonnes/Annum)	Tonnes MSW
Paper	19.20%	229,223	35.03%	220,734	24.7%	449,957		21.38%	90.0%	35.4%	0.0%						
Glass	3.70%	44,173	1.47%	9,288	2.9%	53,461		2.54%	100.0%	0.3%	0.0%						
Plastic	13.80%	164,754	12.17%	76,669	13.2%	241,423	100%	11.47%	100.0%	51.3%	100.0%	129458	107882	86306	77196	64729	
Ferrous	1.50%	17,908	1.00%	6,296	1.3%	24,204		1.15%	100.0%	0.0%	0.0%						
Aluminium	1.40%	16,714	0.57%	3,566	1.1%	20,280		0.96%	100.0%	0.0%	0.0%						
Other Metals	0.40%	4,775	1.23%	7,746	0.7%	12,521		0.59%	100.0%	0.0%	0.0%						

Textiles	11.00%	131,326	2.45%	15,464	8.0%	146,790	50%	6.97%	80.0%	24.9%	50.0%	15282	12735	10188	9113	7641		
Organics	36.20%	432,182	37.34%	235,331	36.6%	667,513		31.72%	40.0%	41.3%	0.2%	231	192	154	138	115		
WEEE	0.80%	9,551	0.44%	2,761	0.7%	12,312		0.58%	100.0%	0.0%	0.0%							
Wood	0.90%	10,745	0.51%	3,194	0.8%	13,939		0.66%	85.0%	50.0%	0.0%							
Others	11.10%	132,520	7.80%	49,145	10.0%	181,665	29%	8.63%	90.0%	11.0%	50.0%	9357	7797	6238	5580	4678		
Sludge						80,000	17.46%	13.33%	10.0%	50.0%	0.0%							
Total Fossil Fuel					20.1%	367,501												
Total Non-Fossil Fuel					79.9%	1,456,564												
Total	100%	1,193,871	100%	630,194	100.0%	1,824,065		100.00%	63.14%	29.59%	19.34%	154329	128607	102886	92026	77164	Tonnes CO2 /annum	
Note Garden Waste 8.6%																		

Incinerator Result Summary

	Annual capacity t/y	LHV GJ/t	MCR hours h	Thermal input MW	Net Power eff %	NetPower output Mwe	District Heating Mwe
	600,000	10.5	8,537	205	29.0%	59.5	**80**
	550,000	10.5	8,537	188	28.5%	53.6	
	500,000	10.5	8,537	171	28.0%	47.8	
	450,000	10.5	8,537	154	27.5%	42.3	
	400,000	10.5	8,537	137	27.0%	36.9	
	357,780	10.5	8,537	122	26.5%	32.4	
	300,000	10.5	8,537	103	26.0%	26.7	
Sludge	520000						
Option	80000	wet					
	8000	dry					

Tonnage

		Current		Landfill Directive
Fraction of carbon content		32.12%	IPCC 2006	37.88%
Fraction of fossil carbon		22.31%	IPCC 2006	45.97%
N20 Emission Factor		0.004	tonnes/GJ	0.004
CH4 Emission Factor		0.03	tonnes/GJ	0.03
CH4 EF Sludge		0.0097	kg/tonne (wet)	
N2O EF Sludge		0.9	kg/tonne (dry)	
Fuel Mix CO2 Emission Factor		0.567	2012 Value	0.567
CCGT N20 Emission Factor		0.0001	tonnes/GJ	0.0001
CCGT CH4 Emission Factor		0.001	tonnes/GJ	0.001

	Capacity	CO_2 Emissions		N2O Emissions		CH4 Emissions		Total		Total 30 Years	
Current	600,000	178036	tonnes	25.2	tonnes	6.3	tonnes	185980	Ton CO2Eq	5.58E+06	Ton CO2Eq
Biogenics	500,000	148363	tonnes	23.1	tonnes	5.8	tonnes	155646	Ton CO2Eq	4.67E+06	Ton CO2Eq
	400,000	118691	tonnes	21.0	tonnes	5.3	tonnes	125311	Ton CO2Eq	3.76E+06	Ton CO2Eq
	357,780	106163	tonnes	18.9	tonnes	4.7	tonnes	112121	Ton CO2Eq	3.36E+06	Ton CO2Eq
	300,000	89018	tonnes	16.8	tonnes	4.2	tonnes	94314	Ton CO2Eq	2.83E+06	Ton CO2Eq
Low Biogenics	600,000	367597	tonnes	25.2	tonnes	6.3	tonnes	375541	Ton CO2Eq	1.13E+07	Ton CO2Eq
Sludge 80,000	600,000	154329	tonnes	29.0	tonnes	6.2	tonnes	163462	Ton CO2Eq	4.90E+06	Ton CO2Eq

GHG Savings In 2005 Terms

		CO_2 Emissions		N2O Emissions		CH4 Emissions		Total		Total 30 Years	
	600,000	295,283	tonnes	0.6	tonnes	6.3	tonnes	295611	Ton CO2Eq	8.87E+06	Ton CO2Eq
	500,000	237,584	tonnes	0.6	tonnes	5.8	tonnes	237885	Ton CO2Eq	7.14E+06	Ton CO2Eq
	400,000	183,279	tonnes	0.5	tonnes	5.3	tonnes	183552	Ton CO2Eq	5.51E+06	Ton CO2Eq
	357,780	160,898	tonnes	0.5	tonnes	4.7	tonnes	161144	Ton CO2Eq	4.83E+06	Ton CO2Eq
	300,000	132,368	tonnes	0.4	tonnes	4.2	tonnes	132587	Ton CO2Eq	3.98E+06	Ton CO2Eq
District Heating	600,000	397,354	tonnes	0.6	tonnes	6.3	tonnes	397681	Ton CO2Eq		

Overall GHG Emissions

Capacity	**Total**		**Total 30 Years**	
600,000	-109631	Ton CO2Eq	-3.29E+06	Ton CO2Eq
500,000	-82239	Ton CO2Eq	-2.47E+06	Ton CO2Eq
400,000	-58242	Ton CO2Eq	-1.75E+06	Ton CO2Eq
357,780	-49023	Ton CO2Eq	-1.47E+06	Ton CO2Eq
300,000	-38273	Ton CO2Eq	-1.15E+06	Ton CO2Eq

Overall Results - IPCC Waste Model

Landfill Methane Generation (CO_2 Equivalent)

	Tonnage					
	600,000	500,000	400,000	300,000	357,780	
75% Recovery	5107	4259	3407	2555	3045	Gg
50% Recovery	10219				6091	Gg
30% Recovery	14308				8527	Gg
20% Recovery	16351				9745	Gg
20% Recovery	10726	(10% organics and 10% paper)			6394	Gg
30% Recovery	9386	(10% organics and 10% paper)			5594	Gg
50% Recovery	6704	(10% organics and 10% paper)			3996	Gg
75% Recovery	3352	(10% organics and 10% paper)			1998	Gg
75% Recovery	4727	80,000 sludge				

Greenhouse Gas Emissions

Capacity	CH4 Emissions		Total		Total 30 Years	
600,000	5.11E+06	tonnes	5.11E+06	Tonnes CO2 Eq	5.11E+06	Tonnes CO2 Equiv
500,000	4.26E+06	tonnes	4.26E+06	Tonnes CO2 Eq	4.26E+06	Tonnes CO2 Equiv
400,000	3.41E+06	tonnes	3.41E+06	Tonnes CO2 Eq	3.41E+06	Tonnes CO2 Equiv
300,000	2.55E+06	tonnes	2.55E+06	Tonnes CO2 Eq	2.55E+06	Tonnes CO2 Equiv
357,780	3.05E+06	tonnes	3.05E+06	Tonnes CO2 Eq	3.05E+06	Tonnes CO2 Equiv
600000 10% bio	3.35E+06	tonnes	3.35E+06	Tonnes CO2 Eq	3.35E+06	Tonnes CO2 Equiv
357780 10% BIO	2.00E+06	tonnes	2.00E+06	Tonnes CO2 Eq	2.00E+06	Tonnes CO2 Equiv

GHG Savings

Capacity	CO_2 Emissions		Total		Total 30 Years	
600,000	13,200	tonnes	13200	Tonnes CO2 Eq	3.96E+05	Tonnes CO2 Equiv
500,000	11,000	tonnes	11000	Tonnes CO2 Eq	3.30E+05	Tonnes CO2 Equiv
400,000	8,800	tonnes	8800	Tonnes CO2 Eq	2.64E+05	Tonnes CO2 Equiv
300,000	6,600	tonnes	6600	Tonnes CO2 Eq	1.98E+05	Tonnes CO2 Equiv
357,780	7,871	tonnes	7871	Tonnes CO2 Eq	2.36E+05	Tonnes CO2 Equiv
600000 10% bio	13,200	tonnes	13200	Tonnes CO2 Eq	3.96E+05	Tonnes CO2 Equiv
357780 10% BIO	7,871	tonnes	7871	Tonnes CO2 Eq	2.36E+05	Tonnes CO2 Equiv

Landfill Methane Sequestered (CO_2 Equivalent)

IPCC	Tonnage					
	600,000				357,780	Gg
75% Recovery	6050				3006	Gg
50% Recovery	6050				3006	Gg
30% Recovery	6050				3006	Gg
20% Recovery	6050				3006	Gg
75% Recovery	5,593	80,000 sludge				
75% Recovery	3994	(10% organics and 10% paper)			2381	Gg

Energy Saving (Raw MSW)	0.022	tonnes CO2 Eq / tonne MSW	**Reference - EU Waste Management Options & Climate Change (2001)**

Overall GHG Emissions	Total30 Years		AD
600,000	-1.34E+06	Tonnes CO2 Eq	
500,000	3.93E+06	Tonnes CO2 Eq	
400,000	3.14E+06	Tonnes CO2 Eq	
300,000	2.36E+06	Tonnes CO2 Eq	
357,780	-1.97E+05	Tonnes CO2 Eq	-1.64E+06
600000 10% bio	-1.04E+06	Tonnes CO2 Eq	

Overall Results

Assumptions

Year	Incineration (tonnes)	Power (MW)	Fuel Efficiency (kg CO2 / kWh)	Renewables	Landfill Gas Recovery
2005			0.637	6.77%	
2012	600000	60	0.567	17.0%	75%
2013	600000	60	0.553	19.0%	75%
2014	600000	60	0.540	21.0%	75%
2015	600000	60	0.526	23.0%	75%
2016	600000	60	0.512	25.0%	75%
2017	600000	60	0.499	27.0%	75%
2018	600000	60	0.485	29.0%	75%
2019	600000	60	0.471	31.0%	75%
2020	600000	60	0.458	33.0%	75%
2021	600000	60	0.451	34.0%	75%
2022	600000	60	0.444	35.0%	75%
2023	600000	60	0.437	36.0%	75%
2024	600000	60	0.430	37.0%	75%
2025	600000	60	0.424	38.0%	75%
2026	600000	60	0.417	39.0%	75%
2027	600000	60	0.410	40.0%	75%
2028	600000	60	0.403	41.0%	75%
2029	600000	60	0.396	42.0%	75%
2030	600000	60	0.389	43.0%	75%
2031	600000	60	0.383	44.0%	75%
2032	600000	60	0.376	45.0%	75%
2033	600000	60	0.369	46.0%	75%
2034	600000	60	0.362	47.0%	75%
2035	600000	60	0.355	48.0%	75%
2036	600000	60	0.348	49.0%	75%
2037	600000	60	0.342	50.0%	75%
2038	600000	60	0.335	51.0%	75%
2039	600000	60	0.328	52.0%	75%
2040	600000	60	0.321	53.0%	75%
2041	600000	60	0.314	54.0%	75%

Scenario 1

75% Capture
600000 To Landfill
Increase In Renewables
Biogenics 71%

Results	Incineration CO2 (tonnes)	Power CO2 (tonnes)	Waste To Energy	Landfill CO2 eq (tonnes)	Power CO2 (tonnes)	Landfill With Energy Recovery	Comparison
2012	185980	-295611	-109630.8	170245	-13200	157045	-296676
2013	185980	-288488	-102507.7	170245	-12882	157363	-258871
2014	185980	-281365	-95384.5	170245	-12564	157681	-254006
2015	185980	-274242	-88261.3	170245	-12246	157999	-194261
2016	185980	-267118	-81138.2	170245	-11928	158317	-239456
2017	185980	-259995	-74015.0	170245	-11610	158635	-232650
2018	185980	-252872	-66891.9	170245	-11292	158954	-225845
2019	185980	-245749	-59768.7	170245	-10973	159272	-219040
2020	185980	-238626	-52645.6	170245	-10655	159590	-212235
2021	185980	-235064	-49084.0	170245	-10496	159749	-208833
2022	185980	-231503	-45522.4	170245	-10337	159908	-205430
2023	185980	-227941	-41960.8	170245	-10178	160067	-202028
2024	185980	-224379	-38399.3	170245	-10019	160226	-198625
2025	185980	-220818	-34837.7	170245	-9860	160385	-195223
2026	185980	-217256	-31276.1	170245	-9701	160544	-191820
2027	185980	-213695	-27714.5	170245	-9542	160703	-188417
2028	185980	-210133	-24152.9	170245	-9383	160862	-185015
2029	185980	-206572	-20591.4	170245	-9224	161021	-181612
2030	185980	-203010	-17029.8	170245	-9065	161180	-178210
2031	185980	-199448	-13468.2	170245	-8906	161339	-174807
2032	185980	-195887	-9906.6	170245	-8747	161498	-171405
2033	185980	-192325	-6345.0	170245	-8588	161657	-168002
2034	185980	-188764	-2783.5	170245	-8429	161816	-164600
2035	185980	-185202	778.1	170245	-8270	161975	-161197
2036	185980	-181640	4339.7	170245	-8111	162134	-157795
2037	185980	-178079	7901.3	170245	-7952	162293	-154392
2038	185980	-174517	11462.8	170245	-7793	162452	-150989
2039	185980	-170956	15024.4	170245	-7634	162611	-147587
2040	185980	-167394	18586.0	170245	-7475	162770	-144184
2041	185980	-163833	22147.6	170245	-7316	162929	-140782

Scenario 2

75% Capture
357780 tonnes To Landfill
Increase in Renewables
Biogenics at current mix
AD 242220 tonnes

Scenario 6

75% Capture
357780 tonnes To Landfill
Increase in Renewables
Biogenics at current mix
AD 242220 tonnes

Results	Incineration CO2 (tonnes)	Power CO2 (tonnes)	Waste To Energy	Landfill CO2 eq (tonnes)	Power CO2 (tonnes)	Landfill With Energy Recovery	AD (tonnes)	Power AD (tonnes)	Total AD (tonnes)	Total (Landfill & AD)	Comparison	Landfill / AD Sequestering (tonnes)	Landfill / AD + Sequestration	Comparison (Sequestering)
2012	185980	-295611	-109630.8	66600	-7871	58729	2340	-33516.7	-31176.9	27552	-137183	-81062	-53510	-56121
2013	185980	-288488	-102507.7	66600	-7681	58919	2340	-32709.1	-30369.3	28549	-131057	-81062	-52513	-49995
2014	185980	-281365	-95384.5	66600	-7492	59108	2340	-31901.5	-29561.6	29547	-124931	-81062	-51516	-43869
2015	185980	-274242	-88261.3	66600	-7302	59298	2340	-31093.8	-28754.0	30544	-118805	-81062	-50518	-37743
2016	185980	-267118	-81138.2	66600	-7112	59488	2340	-30286.2	-27946.4	31541	-112679	-81062	-49521	-31617
2017	185980	-259995	-74015.0	66600	-6923	59677	2340	-29478.6	-27138.7	32538	-106553	-81062	-48524	-25491
2018	185980	-252872	-66891.9	66600	-6733	59867	2340	-28670.9	-26331.1	33536	-100428	-81062	-47526	-19365
2019	185980	-245749	-59768.7	66600	-6543	60057	2340	-27863.3	-25523.5	34533	-94302	-81062	-46529	-13240
2020	185980	-238626	-52645.6	66600	-6354	60246	2340	-27055.7	-24715.8	35530	-88176	-81062	-45532	-7114
2021	185980	-235064	-49084.0	66600	-6259	60341	2340	-26651.9	-24312.0	36029	-85113	-81062	-45033	-4051
2022	185980	-231503	-45522.4	66600	-6164	60436	2340	-26248.0	-23908.2	36528	-82050	-81062	-44535	-988
2023	185980	-227941	-41960.8	66600	-6069	60531	2340	-25844.2	-23504.4	37026	-78987	-81062	-44036	2075
2024	185980	-224379	-38399.3	66600	-5974	60626	2340	-25440.4	-23100.6	37525	-75924	-81062	-43537	5138
2025	185980	-220818	-34837.7	66600	-5880	60720	2340	-25036.6	-22696.7	38024	-72861	-81062	-43039	8201
2026	185980	-217256	-31276.1	66600	-5785	60815	2340	-24632.8	-22292.9	38522	-69798	-81062	-42540	11264
2027	185980	-213695	-27714.5	66600	-5690	60910	2340	-24229.0	-21889.1	39021	-66735	-81062	-42041	14327
2028	185980	-210133	-24152.9	66600	-5595	61005	2340	-23825.1	-21485.3	39520	-63672	-81062	-41543	17390
2029	185980	-206572	-20591.4	66600	-5500	61100	2340	-23421.3	-21081.5	40018	-60610	-81062	-41044	20453
2030	185980	-203010	-17029.8	66600	-5405	61195	2340	-23017.5	-20677.7	40517	-57547	-81062	-40545	23516

2031	185980	-199448	-13468.2	66600	-5311	61289	2340	-22613.7	-20273.9	41015	-54484	-81062	-40047	26579
2032	185980	-195887	-9906.6	66600	-5216	61384	2340	-22209.9	-19870.0	41514	-51421	-81062	-39548	29641
2033	185980	-192325	-6345.0	66600	-5121	61479	2340	-21806.1	-19466.2	42013	-48358	-81062	-39049	32704
2034	185980	-188764	-2783.5	66600	-5026	61574	2340	-21402.3	-19062.4	42511	-45295	-81062	-38551	35767
2035	185980	-185202	778.1	66600	-4931	61669	2340	-20998.4	-18658.6	43010	-42232	-81062	-38052	38830
2036	185980	-181640	4339.7	66600	-4836	61764	2340	-20594.6	-18254.8	43509	-39169	-81062	-37553	41893
2037	185980	-178079	7901.3	66600	-4742	61858	2340	-20190.8	-17851.0	44007	-36106	-81062	-37055	44956
2038	185980	-174517	11462.8	66600	-4647	61953	2340	-19787.0	-17447.1	44506	-33043	-81062	-36556	48019
2039	185980	-170956	15024.4	66600	-4552	62048	2340	-19383.2	-17043.3	45005	-29980	-81062	-36058	51082
2040	185980	-167394	18586.0	66600	-4457	62143	2340	-18979.4	-16639.5	45503	-26917	-81062	-35559	54145
2041	185980	-163833	22147.6	66600	-4362	62238	2340	-18575.5	-16235.7	46002	-23854	-81062	-35060	57208
		Average	-33769.2						Average	38173	-71942		Average	9119.8

Scenario 4

75% Capture
600000 Tn Landfill
Increase in Renewables

Decrease In Biogenics
Over Period 2012 - 2020

Results	Incineration CO2 (tonnes)	Power CO2 (tonnes)	Waste To Energy	Landfill CO2 eq (tonnes)	Power CO2 (tonnes)	Landfill With Energy Recovery	Total (Landfill)	Comparison
2012	185980	-295611	-109630.8	170245	-13200	157045	157045	-266676
2013	209675	-288488	-78812.6	162931	-12882	150049	150049	-228862
2014	233370	-281365	-47994.3	155617	-12564	143053	143053	-191048
2015	257065	-274242	-17176.1	148303	-12246	136057	136057	-153233
2016	280761	-267118	13642.2	140989	-11928	129062	129062	-115419
2017	304456	-259995	44460.5	133675	-11610	122066	122066	-77605
2018	328151	-252872	75278.7	126361	-11292	115070	115070	-39791
2019	351846	-245749	106097.0	119047	-10973	108074	108074	-1977
2020	375541	-238626	136915.2	111733	-10655	101078	101078	35837
2021	375541	-235064	140476.8	111733	-10496	101237	101237	39240
2022	375541	-231503	144038.4	111733	-10337	101396	101396	42642
2023	375541	-227941	147600.0	111733	-10178	101555	101555	46045
2024	375541	-224379	151161.5	111733	-10019	101714	101714	49447
2025	375541	-220818	154723.1	111733	-9860	101873	101873	52850
2026	375541	-217256	158284.7	111733	-9701	102032	102032	56253
2027	375541	-213695	161846.3	111733	-9542	102191	102191	59655
2028	375541	-210133	165407.8	111733	-9383	102350	102350	63058
2029	375541	-206572	168969.4	111733	-9224	102509	102509	66460
2030	375541	-203010	172531.0	111733	-9065	102668	102668	69863
2031	375541	-199448	176092.6	111733	-8906	102827	102827	73265
2032	375541	-195887	179654.2	111733	-8747	102986	102986	76668
2033	375541	-192325	183215.7	111733	-8588	103145	103145	80070
2034	375541	-188764	186777.3	111733	-8429	103304	103304	83473
2035	375541	-185202	190338.9	111733	-8270	103463	103463	86875
2036	375541	-181640	193900.5	111733	-8111	103622	103622	90278
2037	375541	-178079	197462.0	111733	-7952	103782	103782	93681
2038	375541	-174517	201023.6	111733	-7793	103941	103941	97083
2039	375541	-170956	204585.2	111733	-7634	104100	104100	100486
2040	375541	-167394	208146.8	111733	-7475	104259	104259	103888
2041	375541	-163833	211708.4	111733	-7316	104418	104418	107291
							Average	16660

Scenario 7
Sludge 80,000 tonnes

75% Capture
600000 Tn Landfill
Increase In Renewables
Biogenics 71%

Scenario A - No Sequestration
Scenario B - With Sequestration

Results	Incineration CO2 (tonnes)	Power CO2 (tonnes)	Waste To Energy	Landfill CO2 eq (tonnes)	Power CO2 (tonnes)	Landfill With Energy Recovery	Comparison
2012	163462	-295611	-132149.1	157567	-13200	144367	-276516
2013	163462	-288488	-125026.0	157567	-12882	144685	-269711
2014	163462	-281365	-117902.8	157567	-12564	145003	-262906
2015	163462	-274242	-110779.6	157567	-12246	145321	-256101
2016	163462	-267118	-103656.5	157567	-11928	145639	-249295
2017	163462	-259995	-96533.3	157567	-11610	145957	-242490
2018	163462	-252872	-89410.2	157567	-11292	146275	-235685
2019	163462	-245749	-82287.0	157567	-10973	146593	-228880
2020	163462	-238626	-75163.9	157567	-10655	146911	-222075
2021	163462	-235064	-71602.3	157567	-10496	147070	-218673
2022	163462	-231503	-68040.7	157567	-10337	147229	-215270
2023	163462	-227941	-64479.1	157567	-10178	147388	-211867
2024	163462	-224379	-60917.5	157567	-10019	147547	-208465
2025	163462	-220818	-57356.0	157567	-9860	147706	-205062
2026	163462	-217256	-53794.4	157567	-9701	147865	-201660
2027	163462	-213695	-50232.8	157567	-9542	148024	-198257
2028	163462	-210133	-46671.2	157567	-9383	148184	-194855
2029	163462	-206572	-43109.7	157567	-9224	148343	-191452
2030	163462	-203010	-39548.1	157567	-9065	148502	-188050
2031	163462	-199448	-35986.5	157567	-8906	148661	-184647
2032	163462	-195887	-32424.9	157567	-8747	148820	-181245
2033	163462	-192325	-28863.3	157567	-8588	148979	-177842
2034	163462	-188764	-25301.8	157567	-8429	149138	-174440
2035	163462	-185202	-21740.2	157567	-8270	149297	-171037
2036	163462	-181640	-18178.6	157567	-8111	149456	-167634

Scenario 8

District Heating

75% Capture
357780 tonnes To Landfill
Increase in Renewables
Biogenics at current mix
AD 242220 tonnes

Results	Incineration CO2 (tonnes)	Power CO2 (tonnes)	le To Energy & District He	Landfill CO2 eq (tonnes)	Power CO2 (tonnes)	Landfill With Energy Recovery	AD (tonnes)	Power AD (tonnes)	Total AD (tonnes)	Total (Landfill & AD)	Landfill / AD Sequestering (tonnes)	Landfill / AD + Sequestration	Comparison (Sequestering)
2013	185980	-397681	-211701.0	66600	-7871	58729	2340	-33516.7	-31176.9	27552	-81062	-53510	-158190.8
2014	185980	-388099	-202118.3	66600	-7681	58919	2340	-32709.1	-30369.3	28549	-81062	-52513	-149605.4
2015	185980	-378516	-192535.7	66600	-7492	59108	2340	-31901.5	-29561.6	29547	-81062	-51516	-141020.0
2016	185980	-368933	-182953.0	66600	-7302	59298	2340	-31093.8	-28754.0	30544	-81062	-50518	-132434.6
2017	185980	-359350	-173370.3	66600	-7112	59488	2340	-30286.2	-27946.4	31541	-81062	-49521	-123849.2
2018	185980	-349768	-163787.6	66600	-6923	59677	2340	-29478.6	-27138.7	32538	-81062	-48524	-115263.9
2019	185980	-340185	-154204.9	66600	-6733	59867	2340	-28670.9	-26331.1	33536	-81062	-47526	-106678.5
2020	185980	-330602	-144622.3	66600	-6543	60057	2340	-27863.3	-25523.5	34533	-81062	-46529	-98093.1
2021	185980	-321020	-135039.6	66600	-6354	60246	2340	-27055.7	-24715.8	35530	-81062	-45532	-89507.7
2022	185980	-316228	-130248.2	66600	-6259	60341	2340	-26651.9	-24312.0	36029	-81062	-45033	-85215.0
2023	185980	-311437	-125456.9	66600	-6164	60436	2340	-26248.0	-23908.2	36528	-81062	-44535	-80922.3
2024	185980	-306646	-120665.6	66600	-6069	60531	2340	-25844.2	-23504.4	37026	-81062	-44036	-76629.7
2025	185980	-301854	-115874.2	66600	-5974	60626	2340	-25440.4	-23100.6	37525	-81062	-43537	-72337.0
2026	185980	-297063	-111082.9	66600	-5880	60720	2340	-25036.6	-22696.7	38024	-81062	-43039	-68044.3
2027	185980	-292272	-106291.6	66600	-5785	60815	2340	-24632.8	-22292.9	38522	-81062	-42540	-63751.6

2028	185980	-287480	-101500.2	66600	-5690	60910	2340	-24229.0	-21889.1	39021	-81062	-42041	-59458.9
2029	185980	-282689	-96708.9	66600	-5595	61005	2340	-23825.1	-21485.3	39520	-81062	-41543	-55166.2
2030	185980	-277898	-91917.5	66600	-5500	61100	2340	-23421.3	-21081.5	40018	-81062	-41044	-50873.5
2031	185980	-273106	-87126.2	66600	-5405	61195	2340	-23017.5	-20677.7	40517	-81062	-40545	-46580.8
2032	185980	-268315	-82334.9	66600	-5311	61289	2340	-22613.7	-20273.9	41015	-81062	-40047	-42288.1
2033	185980	-263524	-77543.5	66600	-5216	61384	2340	-22209.9	-19870.0	41514	-81062	-39548	-37995.4
2034	185980	-258732	-72752.2	66600	-5121	61479	2340	-21806.1	-19466.2	42013	-81062	-39049	-33702.7
2035	185980	-253941	-67960.8	66600	-5026	61574	2340	-21402.3	-19062.4	42511	-81062	-38551	-29410.1
2036	185980	-249150	-63169.5	66600	-4931	61669	2340	-20998.4	-18658.6	43010	-81062	-38052	-25117.4
2037	185980	-244358	-58378.2	66600	-4836	61764	2340	-20594.6	-18254.8	43509	-81062	-37553	-20824.7
2038	185980	-239567	-53586.8	66600	-4742	61858	2340	-20190.8	-17851.0	44007	-81062	-37055	-16532.0
2039	185980	-234776	-48795.5	66600	-4647	61953	2340	-19787.0	-17447.1	44506	-81062	-36556	-12239.3
2040	185980	-229984	-44004.1	66600	-4552	62048	2340	-19383.2	-17043.3	45005	-81062	-36058	-7946.6
2041	185980	-225193	-39212.8	66600	-4457	62143	2340	-18979.4	-16639.5	45503	-81062	-35559	-3653.9
		Average	-112239.4						Average	37903			-69080.4
										-150142.6			

Anaerobic Digestion Emission Factors

	Tonnage			
Inputs	242220			
Power	Eunomia	**244**	kWh/tonne of waste	**Source - Eunomia A Changing Climate for Energy From Waste (2006)**
	P.27	**6.75**	MW/242220 tonne of waste	Page 27
	EU	180.00	kWh / tonnes of waste	
	p.164		based on 30% efficiency	
				Source - EU Waste Management Options & Climate Change (2001)
EU	Emission Factors			P.163
Emissions		CH4		
	AD	0.46		
	Released	kg CH4 / tonne waste treated		
	AD	111.4212		
		tonnes		
	AD	**2339.8**		
	Released	**tonnes CO2 Eq**		
Sequestration				**Source - EU Waste Management Options & Climate Change (2001)**
EU Data	Emission Factor			Page 37
	AD	7		
		kg CO2 eq / tonne		
		1695.54		
		tonnes		

Overall Results

Assumptions Year	Incineration (tonnes)	Power (MW)	Fuel Efficiency (kg CO2 / kWh)	Renewables	Landfill Gas Recovery
2005			0.637	6.77%	
2012	600000	60	0.567	17.0%	75%
2013	600000	60	0.553	19.0%	75%
2014	600000	60	0.540	21.0%	75%
2015	600000	60	0.526	23.0%	75%
2016	600000	60	0.512	25.0%	75%
2017	600000	60	0.499	27.0%	75%
2018	600000	60	0.485	29.0%	75%
2019	600000	60	0.471	31.0%	75%
2020	600000	60	0.458	33.0%	75%
2021	600000	60	0.451	34.0%	75%
2022	600000	60	0.444	35.0%	75%
2023	600000	60	0.437	36.0%	75%
2024	600000	60	0.430	37.0%	75%
2025	600000	60	0.424	38.0%	75%
2026	600000	60	0.417	39.0%	75%
2027	600000	60	0.410	40.0%	75%
2028	600000	60	0.403	41.0%	75%
2029	600000	60	0.396	42.0%	75%
2030	600000	60	0.389	43.0%	75%
2031	600000	60	0.383	44.0%	75%
2032	600000	60	0.376	45.0%	75%
2033	600000	60	0.369	46.0%	75%
2034	600000	60	0.362	47.0%	75%
2035	600000	60	0.355	48.0%	75%
2036	600000	60	0.348	49.0%	75%
2037	600000	60	0.342	50.0%	75%
2038	600000	60	0.335	51.0%	75%
2039	600000	60	0.328	52.0%	75%
2040	600000	60	0.321	53.0%	75%
2041	600000	60	0.314	54.0%	75%

Scenario 3b

75% Capture
500000 To Landfill
Increase In Renewables
Biogenics 71%

Results	Incineration CO2 (tonnes)	Power CO2 (tonnes)	Waste To Energy	Landfill CO2 eq (tonnes)	Power CO2 (tonnes)	Landfill With Energy Recovery	Comparison
2012	155646	-237885	-82239.1	141967	-11000	130967	-213206
2013	155646	-232152	-76507.0	141967	-10735	131232	-207739
2014	155646	-226420	-70774.8	141967	-10470	131497	-202272
2015	155646	-220688	-65042.7	141967	-10205	131762	-196805
2016	155646	-214956	-59310.5	141967	-9940	132027	-191337
2017	155646	-209224	-53578.3	141967	-9675	132292	-185870
2018	155646	-203492	-47846.2	141967	-9410	132557	-180403
2019	155646	-197760	-42114.0	141967	-9145	132822	-174936
2020	155646	-192027	-36381.9	141967	-8880	133087	-169469
2021	155646	-189161	-33515.8	141967	-8747	133220	-166735
2022	155646	-186295	-30649.7	141967	-8614	133352	-164002
2023	155646	-183429	-27783.6	141967	-8482	133485	-161268
2024	155646	-180563	-24917.5	141967	-8349	133617	-158535
2025	155646	-177697	-22051.5	141967	-8217	133750	-155801
2026	155646	-174831	-19185.4	141967	-8084	133882	-153068
2027	155646	-171965	-16319.3	141967	-7952	134015	-150334
2028	155646	-169099	-13453.2	141967	-7819	134147	-147601
2029	155646	-166233	-10587.1	141967	-7687	134280	-144867
2030	155646	-163367	-7721.1	141967	-7554	134412	-142134
2031	155646	-160500	-4855.0	141967	-7422	134545	-139400
2032	155646	-157634	-1988.9	141967	-7289	134678	-136666
2033	155646	-154768	877.2	141967	-7157	134810	-133933
2034	155646	-151902	3743.3	141967	-7024	134943	-131199
2035	155646	-149036	6609.3	141967	-6892	135075	-128466
2036	155646	-146170	9475.4	141967	-6759	135208	-125732
2037	155646	-143304	12341.5	141967	-6627	135340	-122999
2038	155646	-140438	15207.6	141967	-6494	135473	-120265
2039	155646	-137572	18073.7	141967	-6361	135605	-117532
2040	155646	-134706	20939.7	141967	-6229	135738	-114798
2041	155646	-131840	23805.8	141967	-6096	135870	-112064

Scenario 3c

75% Capture
400000 To Landfill
Increase In Renewables
Biogenics 71%

Results	Incineration CO2 (tonnes)	Power CO2 (tonnes)	Waste To Energy	Landfill CO2 eq (tonnes)	Power CO2 (tonnes)	Landfill With Energy Recovery	Comparison
2012	125311	-183552	-58241.5	113567	-8800	104767	-163008
2013	125311	-179129	-53818.6	113567	-8588	104979	-158797
2014	125311	-174706	-49395.6	113567	-8376	105191	-154586
2015	125311	-170284	-44972.7	113567	-8164	105403	-150375
2016	125311	-165861	-40549.7	113567	-7952	105615	-146165
2017	125311	-161438	-36126.8	113567	-7740	105827	-141954
2018	125311	-157015	-31703.8	113567	-7528	106039	-137743
2019	125311	-152592	-27280.9	113567	-7316	106251	-133532
2020	125311	-148169	-22857.9	113567	-7104	106463	-129321
2021	125311	-145957	-20646.5	113567	-6998	106569	-127216
2022	125311	-143746	-18435.0	113567	-6892	106675	-125110
2023	125311	-141534	-16223.5	113567	-6786	106781	-123005
2024	125311	-139323	-14012.0	113567	-6680	106887	-120899
2025	125311	-137111	-11800.6	113567	-6573	106993	-118794
2026	125311	-134900	-9589.1	113567	-6467	107099	-116688
2027	125311	-132688	-7377.6	113567	-6361	107205	-114583
2028	125311	-130477	-5166.1	113567	-6255	107311	-112477
2029	125311	-128265	-2954.7	113567	-6149	107417	-110372
2030	125311	-126054	-743.2	113567	-6043	107523	-108266
2031	125311	-123843	1468.3	113567	-5937	107629	-106161
2032	125311	-121631	3679.8	113567	-5831	107735	-104056
2033	125311	-119420	5891.2	113567	-5725	107841	-101950
2034	125311	-117208	8102.7	113567	-5619	107947	-99845
2035	125311	-114997	10314.2	113567	-5513	108053	-97739
2036	125311	-112785	12525.7	113567	-5407	108159	-95634
2037	125311	-110574	14737.1	113567	-5301	108265	-93528
2038	125311	-108362	16948.6	113567	-5195	108371	-91423
2039	125311	-106151	19160.1	113567	-5089	108478	-89317
2040	125311	-103939	21371.6	113567	-4983	108584	-87212
2041	125311	-101728	23583.0	113567	-4877	108690	-85107

Scenario 3d

75% Capture
300000 To Landfill
Increase In Renewables
Biogenics 71%

Results	Incineration CO2 (tonnes)	Power CO2 (tonnes)	Waste To Energy	Landfill CO2 eq (tonnes)	Power CO2 (tonnes)	Landfill With Energy Recovery	Comparison
2012	112121	-161144	-49023.1	85160	-6600	78560	-127583
2013	112121	-157261	-45140.1	85160	-6441	78719	-123859
2014	112121	-153378	-41257.1	85160	-6282	78878	-120135
2015	112121	-149495	-37374.1	85160	-6123	79037	-116411
2016	112121	-145612	-33491.1	85160	-5964	79196	-112687
2017	112121	-141729	-29608.1	85160	-5805	79355	-108963
2018	112121	-137846	-25725.1	85160	-5646	79514	-105239
2019	112121	-133963	-21842.1	85160	-5487	79673	-101515
2020	112121	-130080	-17959.2	85160	-5328	79832	-97791
2021	112121	-128139	-16017.7	85160	-5248	79912	-95929
2022	112121	-126197	-14076.2	85160	-5169	79991	-94067
2023	112121	-124256	-12134.7	85160	-5089	80071	-92206
2024	112121	-122314	-10193.2	85160	-5010	80150	-90344
2025	112121	-120373	-8251.7	85160	-4930	80230	-88482
2026	112121	-118431	-6310.2	85160	-4851	80309	-86620
2027	112121	-116490	-4368.7	85160	-4771	80389	-84758
2028	112121	-114548	-2427.2	85160	-4692	80468	-82896
2029	112121	-112607	-485.7	85160	-4612	80548	-81034
2030	112121	-110665	1455.8	85160	-4533	80627	-79172
2031	112121	-108724	3397.3	85160	-4453	80707	-77310
2032	112121	-106782	5338.8	85160	-4373	80787	-75448
2033	112121	-104841	7280.3	85160	-4294	80866	-73586
2034	112121	-102899	9221.8	85160	-4214	80946	-71724
2035	112121	-100958	11163.3	85160	-4135	81025	-69862
2036	112121	-99016	13104.8	85160	-4055	81105	-68000
2037	112121	-97075	15046.3	85160	-3976	81184	-66138
2038	112121	-95133	16987.8	85160	-3896	81264	-64276
2039	112121	-93192	18929.3	85160	-3817	81343	-62414
2040	112121	-91250	20870.7	85160	-3737	81423	-60552
2041	112121	-89309	22812.2	85160	-3658	81502	-58690

Overall Results

Assumptions Year	Incineration (tonnes)	Power (MW)	Fuel Efficiency (kg CO2 / kWh)	Renewables	Landfill Gas Recovery
2005			0.637	6.77%	
2012	600000	60	0.567	17.0%	75%
2013	600000	60	0.553	19.0%	75%
2014	600000	60	0.540	21.0%	75%
2015	600000	60	0.526	23.0%	75%
2016	600000	60	0.512	25.0%	75%
2017	600000	60	0.499	27.0%	75%
2018	600000	60	0.485	29.0%	75%
2019	600000	60	0.471	31.0%	75%
2020	600000	60	0.458	33.0%	75%
2021	600000	60	0.451	34.0%	75%
2022	600000	60	0.444	35.0%	75%
2023	600000	60	0.437	36.0%	75%
2024	600000	60	0.430	37.0%	75%
2025	600000	60	0.424	38.0%	75%
2026	600000	60	0.417	39.0%	75%
2027	600000	60	0.410	40.0%	75%
2028	600000	60	0.403	41.0%	75%
2029	600000	60	0.396	42.0%	75%
2030	600000	60	0.389	43.0%	75%
2031	600000	60	0.383	44.0%	75%
2032	600000	60	0.376	45.0%	75%
2033	600000	60	0.369	46.0%	75%
2034	600000	60	0.362	47.0%	75%
2035	600000	60	0.355	48.0%	75%
2036	600000	60	0.348	49.0%	75%
2037	600000	60	0.342	50.0%	75%
2038	600000	60	0.335	51.0%	75%
2039	600000	60	0.328	52.0%	75%
2040	600000	60	0.321	53.0%	75%
2041	600000	60	0.314	54.0%	75%

Scenario 5b

50% Capture
600000 Tn Landfill
Increase in Renewables

Decrease In Biogenics
Over Period 2012 - 2020

Results	Incineration CO2 (tonnes)	Power CO2 (tonnes)	Waste To Energy	Landfill CO2 eq (tonnes)	Power CO2 (tonnes)	Landfill With Energy Recovery	Total (Landfill)	Comparison
2012	185980	-295611	-109630.8	340640	-13200	327440	327440	-437071
2013	209675	-288488	-78812.6	325993	-12882	313111	313111	-391924
2014	233370	-281365	-47994.3	311347	-12564	298783	298783	-346777
2015	257065	-274242	-17176.1	296700	-12246	284454	284454	-301630
2016	280761	-267118	13642.2	282053	-11928	270126	270126	-256483
2017	304456	-259995	44460.5	267407	-11610	255797	255797	-211337
2018	328151	-252872	75278.7	252760	-11292	241468	241468	-166190
2019	351846	-245749	106097.0	238113	-10973	227140	227140	-121043
2020	375541	-238626	136915.2	223467	-10655	212811	212811	-75896
2021	375541	-235064	140476.8	223467	-10496	212970	212970	-72493
2022	375541	-231503	144038.4	223467	-10337	213129	213129	-69091
2023	375541	-227941	147600.0	223467	-10178	213288	213288	-65688
2024	375541	-224379	151161.5	223467	-10019	213447	213447	-62286
2025	375541	-220818	154723.1	223467	-9860	213606	213606	-58883
2026	375541	-217256	158284.7	223467	-9701	213765	213765	-55481
2027	375541	-213695	161846.3	223467	-9542	213924	213924	-52078
2028	375541	-210133	165407.8	223467	-9383	214084	214084	-48676
2029	375541	-206572	168969.4	223467	-9224	214243	214243	-45273
2030	375541	-203010	172531.0	223467	-9065	214402	214402	-41871
2031	375541	-199448	176092.6	223467	-8906	214561	214561	-38468
2032	375541	-195887	179654.2	223467	-8747	214720	214720	-35066
2033	375541	-192325	183215.7	223467	-8588	214879	214879	-31663
2034	375541	-188764	186777.3	223467	-8429	215038	215038	-28260
2035	375541	-185202	190338.9	223467	-8270	215197	215197	-24858
2036	375541	-181640	193900.5	223467	-8111	215356	215356	-21455
2037	375541	-178079	197462.0	223467	-7952	215515	215515	-18053
2038	375541	-174517	201023.6	223467	-7793	215674	215674	-14650
2039	375541	-170956	204585.2	223467	-7634	215833	215833	-11248
2040	375541	-167394	208146.8	223467	-7475	215992	215992	-7845
2041	375541	-163833	211708.4	223467	-7316	216151	216151	-4443

Scenario 5c

30% Capture
600000 Tn Landfill
Increase in Renewables

Decrease In Biogenics
Over Period 2012 - 2020

Results	Incineration CO2 (tonnes)	Power CO2 (tonnes)	Waste To Energy	Landfill CO2 eq (tonnes)	Power CO2 (tonnes)	Landfill With Energy Recovery	Total (Landfill)	Comparison
2012	185980	-295611	-109630.8	476933	-13200	463733	463733	-573364
2013	209675	-288488	-78812.6	456423	-12882	443541	443541	-522354
2014	233370	-281365	-47994.3	435913	-12564	423349	423349	-471344
2015	257065	-274242	-17176.1	415403	-12246	403158	403158	-420334
2016	280761	-267118	13642.2	394893	-11928	382966	382966	-369323
2017	304456	-259995	44460.5	374383	-11610	362774	362774	-318313
2018	328151	-252872	75278.7	353873	-11292	342582	342582	-267303
2019	351846	-245749	106097.0	333363	-10973	322390	322390	-216293
2020	375541	-238626	136915.2	312853	-10655	302198	302198	-165283
2021	375541	-235064	140476.8	312853	-10496	302357	302357	-161880
2022	375541	-231503	144038.4	312853	-10337	302516	302516	-158478
2023	375541	-227941	147600.0	312853	-10178	302675	302675	-155075
2024	375541	-224379	151161.5	312853	-10019	302834	302834	-151673
2025	375541	-220818	154723.1	312853	-9860	302993	302993	-148270
2026	375541	-217256	158284.7	312853	-9701	303152	303152	-144867
2027	375541	-213695	161846.3	312853	-9542	303311	303311	-141465
2028	375541	-210133	165407.8	312853	-9383	303470	303470	-138062
2029	375541	-206572	168969.4	312853	-9224	303629	303629	-134660
2030	375541	-203010	172531.0	312853	-9065	303788	303788	-131257
2031	375541	-199448	176092.6	312853	-8906	303947	303947	-127855
2032	375541	-195887	179654.2	312853	-8747	304106	304106	-124452
2033	375541	-192325	183215.7	312853	-8588	304265	304265	-121050
2034	375541	-188764	186777.3	312853	-8429	304424	304424	-117647
2035	375541	-185202	190338.9	312853	-8270	304583	304583	-114245
2036	375541	-181640	193900.5	312853	-8111	304742	304742	-110842
2037	375541	-178079	197462.0	312853	-7952	304902	304902	-107439
2038	375541	-174517	201023.6	312853	-7793	305061	305061	-104037
2039	375541	-170956	204585.2	312853	-7634	305220	305220	-100634
2040	375541	-167394	208146.8	312853	-7475	305379	305379	-97232
2041	375541	-163833	211708.4	312853	-7316	305538	305538	-93829

Scenario 5d

30% Capture
600000 Tn Landfill
Increase in Renewables

Decrease In Biogenics
Over Period 2012 - 2020

Results	Incineration CO2 (tonnes)	Power CO2 (tonnes)	Waste To Energy	Landfill CO2 eq (tonnes)	Power CO2 (tonnes)	Landfill With Energy Recovery	Total (Landfill)	Comparison
2012	185980	-295611	-109630.8	549840	-13200	531840	531840	-641471
2013	209675	-288488	-78812.6	524530	-12882	511648	511648	-590461
2014	233370	-281365	-47994.3	504220	-12564	491456	491456	-539450
2015	257065	-274242	-17176.1	483510	-12246	471264	471264	-488440
2016	280761	-267118	13642.2	463000	-11928	451072	451072	-437430
2017	304456	-259995	44460.5	442490	-11610	430880	430880	-386420
2018	328151	-252872	75278.7	421980	-11292	410688	410688	-335410
2019	351846	-245749	106097.0	401470	-10973	390497	390497	-284400
2020	375541	-238626	136915.2	357547	-10655	346891	346891	-209976
2021	375541	-235064	140476.8	357547	-10496	347050	347050	-206573
2022	375541	-231503	144038.4	357547	-10337	347209	347209	-203171
2023	375541	-227941	147600.0	357547	-10178	347368	347368	-199768
2024	375541	-224379	151161.5	357547	-10019	347527	347527	-196366
2025	375541	-220818	154723.1	357547	-9860	347686	347686	-192963
2026	375541	-217256	158284.7	357547	-9701	347845	347845	-189561
2027	375541	-213695	161846.3	357547	-9542	348004	348004	-186158
2028	375541	-210133	165407.8	357547	-9383	348164	348164	-182756
2029	375541	-206572	168969.4	357547	-9224	348323	348323	-179353
2030	375541	-203010	172531.0	357547	-9065	348482	348482	-175951
2031	375541	-199448	176092.6	357547	-8906	348641	348641	-172548
2032	375541	-195887	179654.2	357547	-8747	348800	348800	-169146
2033	375541	-192325	183215.7	357547	-8588	348959	348959	-165743
2034	375541	-188764	186777.3	357547	-8429	349118	349118	-162340
2035	375541	-185202	190338.9	357547	-8270	349277	349277	-158938
2036	375541	-181640	193900.5	357547	-8111	349436	349436	-155535
2037	375541	-178079	197462.0	357547	-7952	349595	349595	-152133
2038	375541	-174517	201023.6	357547	-7793	349754	349754	-148730
2039	375541	-170956	204585.2	357547	-7634	349913	349913	-145328
2040	375541	-167394	208146.8	357547	-7475	350072	350072	-141925
2041	375541	-163833	211708.4	357547	-7316	350231	350231	-138523

Parameters

Country Ireland

Region

Please enter parameters in the yellow cells. If no national data are available, copy the IPCC default value.
Help on parameter selection can be found in the 2006 IPCC guidelines

	IPCC		Country-specific parameters		
			Value	Reference and remarks	Notes
Starting year		1950	2012		
DOC (Degradable organic carbon)					
(weight fraction, wet basis)	**Range**	**Default**			
Food waste	0.08-0.20	0.15	0.15		May include garden waste provided that a suitable value of DOC is used
Garden	0.18-0.22	0.2	0.2		Garden (yard) and park waste and other moderately fast degrading waste
Paper	0.36-0.45	0.4	0.4		
Wood and straw	0.39-0.46	0.43	0.43		
Textiles	0.20-0.40	0.24	0.24		Natural textiles such as wool and cotton. The default DOC value assumes 40% of textiles are synthetic materials that do not contain DOC
Disposable nappies	0.18-0.32	0.24	0.24		
Sewage sludge	0.04-0.05	0.05	0.05		
Industrial waste	0-0.54	0.15	0.15		The composition of industrial waste will vary significantly by country. This DOC value should match the amounts entered (see Guidelines).
DOCf (fraction of DOC dissimilated)		0.5	0.5		
Methane generation rate constant (k)					
(years^{-1})	**Range**	**Default**			
Food waste	0.1–0.2	0.185	0.185		May include garden waste provided that a suitable value of DOC is used
Garden	0.06–0.1	0.1	0.1		Garden (yard) and park waste and other moderately fast degrading waste
Paper	0.05–0.07	0.06	0.06		
Wood and straw	0.02–0.04	0.03	0.03		
Textiles	0.05–0.07	0.06	0.06		Natural textiles such as wool and cotton. Synthetic textiles are assumed not to contain DOC
Disposable nappies	0.06–0.1	0.1	0.1		
Sewage sludge	0.1–0.2	0.185	0.185		
Industrial waste	0.08–0.1	0.09	0.09		The composition of industrial waste will vary significantly by country. This DOC value should match the amounts entered (see Guidelines).
Delay time (months)		6	6		
Fraction of methane (F) in developed gas		0.5	0.5		
Conversion factor, C to CH_4		1.33	1.33		
Oxidation factor (OX)		0	0.1		
Parameters for carbon storage					
% paper in industrial waste		0%	0%		
% wood in industrial waste		0%	0%		
For Harvested Wood Products calculations for Bulk waste option only:					

Methane Correction Factor (MCF)

This worksheet calculates a weighted average MCF from the estimated distribution of site types
Enter either IPCC default values or national values into the yellow MCF cells in row 12
Then enter the approximate distribution of waste disposals (by mass) between site types in the columns below.
Totals on each row must add up to 100% (see "distribution check" values)

	MSW						Industrial						
	Un-managed, shallow	Un-managed, deep	Managed	Managed, semi-aerobic	Uncate-gorised	Distri-bution Check	Un-managed, shallow	Un-managed, deep	Managed	Managed, semi-aerobic	Uncate-gorised	Distri-bution Check	References / remarks
	MCF	MCF	MCF	MCF	MCF		MCF	MCF	MCF	MCF	MCF		
IPCC default	0.4	0.8	1	0.5	0.6		0.4	0.8	1	0.5	0.6		
Country-specific value	0.4	0.8	1	0.5	0.6		0.4	0.8	1	0.5	0.6		
	Distribution of Waste by Waste Management Type						Distribution of Waste by Waste Management Type						
"Fixed" Country-specifc value	0%	0%	100%	0%	0%	Total						Total	
Year	%	%	%	%	%	(100%)	%	%	%	%	%	(100%)	
2012	0%	0%	100%	0%	0%	100%						0%	
2013	0%	0%	100%	0%	0%	100%						0%	
2014	0%	0%	100%	0%	0%	100%						0%	
2015	0%	0%	100%	0%	0%	100%						0%	
2016	0%	0%	100%	0%	0%	100%						0%	
2017	0%	0%	100%	0%	0%	100%						0%	
2018	0%	0%	100%	0%	0%	100%						0%	
2019	0%	0%	100%	0%	0%	100%						0%	
2020	0%	0%	100%	0%	0%	100%						0%	
2021	0%	0%	100%	0%	0%	100%						0%	
2022	0%	0%	100%	0%	0%	100%						0%	
2023	0%	0%	100%	0%	0%	100%						0%	
2024	0%	0%	100%	0%	0%	100%						0%	
2025	0%	0%	100%	0%	0%	100%						0%	
2026	0%	0%	100%	0%	0%	100%						0%	
2027	0%	0%	100%	0%	0%	100%						0%	
2028	0%	0%	100%	0%	0%	100%						0%	
2029	0%	0%	100%	0%	0%	100%						0%	
2030	0%	0%	100%	0%	0%	100%						0%	
2031	0%	0%	100%	0%	0%	100%						0%	
2032	0%	0%	100%	0%	0%	100%						0%	
2033	0%	0%	100%	0%	0%	100%						0%	
2034	0%	0%	100%	0%	0%	100%						0%	
2035	0%	0%	100%	0%	0%	100%						0%	
2036	0%	0%	100%	0%	0%	100%						0%	
2037	0%	0%	100%	0%	0%	100%						0%	
2038	0%	0%	100%	0%	0%	100%						0%	
2039	0%	0%	100%	0%	0%	100%						0%	
2040	0%	0%	100%	0%	0%	100%						0%	
2041	0%	0%	100%	0%	0%	100%						0%	
2042						0%						0%	
2043						0%						0%	
2044						0%						0%	
2045						0%						0%	
2046						0%						0%	
2047						0%						0%	
2048						0%						0%	
2049						0%						0%	
2050						0%						0%	
2051						0%						0%	
2052						0%						0%	

Calculated values for MCF

MSW	Industrial
Weighted average MCF for MSW	Weighted average MCF for Industrial Waste
wt. fraction	wt. fraction
1.00	0.00
1.00	0.00
1.00	0.00
1.00	0.00
1.00	0.00
1.00	0.00
1.00	0.00
1.00	0.00
1.00	0.00
1.00	0.00
1.00	0.00
1.00	0.00
1.00	0.00
1.00	0.00
1.00	0.00
1.00	0.00
1.00	0.00
1.00	0.00
1.00	0.00
1.00	0.00
1.00	0.00
1.00	0.00
1.00	0.00
1.00	0.00
1.00	0.00
1.00	0.00
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1.00	0.00
1.00	0.00
1.00	0.00
0.00	0.00
0.00	0.00
0.00	0.00
0.00	0.00
0.00	0.00
0.00	0.00
0.00	0.00
0.00	0.00
0.00	0.00
0.00	0.00
0.00	0.00

2053						0%						0%		0.00	0.00
2054						0%						0%		0.00	0.00
2055						0%						0%		0.00	0.00
2056						0%						0%		0.00	0.00
2057						0%						0%		0.00	0.00
2058						0%						0%		0.00	0.00
2059						0%						0%		0.00	0.00
2060						0%						0%		0.00	0.00
2061						0%						0%		0.00	0.00
2062						0%						0%		0.00	0.00
2063						0%						0%		0.00	0.00
2064						0%						0%		0.00	0.00
2065						0%						0%		0.00	0.00
2066						0%						0%		0.00	0.00
2067						0%						0%		0.00	0.00
2068						0%						0%		0.00	0.00
2069						0%						0%		0.00	0.00
2070						0%						0%		0.00	0.00
2071						0%						0%		0.00	0.00
2072						0%						0%		0.00	0.00
2073						0%						0%		0.00	0.00
2074						0%						0%		0.00	0.00
2075						0%						0%		0.00	0.00
2076						0%						0%		0.00	0.00
2077						0%						0%		0.00	0.00
2078						0%						0%		0.00	0.00
2079						0%						0%		0.00	0.00
2080						0%						0%		0.00	0.00
2081						0%						0%		0.00	0.00
2082						0%						0%		0.00	0.00
2083						0%						0%		0.00	0.00
2084						0%						0%		0.00	0.00
2085						0%						0%		0.00	0.00
2086						0%						0%		0.00	0.00
2087						0%						0%		0.00	0.00
2088						0%						0%		0.00	0.00
2089						0%						0%		0.00	0.00
2090						0%						0%		0.00	0.00
2091						0%						0%		0.00	0.00
2092						0%						0%		0.00	0.00

MSW activity data

Enter population, waste per capita and MSW waste composition into the yellow cells.
Help and default regional values are given in the 2006 IPCC Guidelines.
Industrial waste activity data must be entered separately starting in Column Q.

IPCC Regional defaults

			47%	24%	0%	28%	11%	0%	0%	37%	100%
				Composition of waste going to solid waste disposal sites							
Year	Population	Waste per capita	Total MSW	% to SWDS	Food	Garden	Paper	Wood	Textile	Nappies	Plastics, other inert	Total
	millions	kg/cap/yr	Gg	%	%	%	%	%	%	%	%	(=100%)
2012	1.24	740	917.6	65%	25%	9%	25%	1%	8%	3%	30%	100%
2013	1.24	740	917.6	65%	25%	9%	25%	1%	8%	3%	30%	100%
2014	1.24	740	917.6	65%	25%	9%	25%	1%	8%	3%	30%	100%
2015	1.24	740	917.6	65%	25%	9%	25%	1%	8%	3%	30%	100%
2016	1.24	740	917.6	65%	25%	9%	25%	1%	8%	3%	30%	100%
2017	1.24	740	917.6	65%	25%	9%	25%	1%	8%	3%	30%	100%
2018	1.24	740	917.6	65%	25%	9%	25%	1%	8%	3%	30%	100%
2019	1.24	740	917.6	65%	25%	9%	25%	1%	8%	3%	30%	100%
2020	1.24	740	917.6	65%	25%	9%	25%	1%	8%	3%	30%	100%
2021	1.24	740	917.6	65%	25%	9%	25%	1%	8%	3%	30%	100%
2022	1.24	740	917.6	65%	25%	9%	25%	1%	8%	3%	30%	100%
2023	1.24	740	917.6	65%	25%	9%	25%	1%	8%	3%	30%	100%
2024	1.24	740	917.6	65%	25%	9%	25%	1%	8%	3%	30%	100%
2025	1.24	740	917.6	65%	25%	9%	25%	1%	8%	3%	30%	100%
2026	1.24	740	917.6	65%	25%	9%	25%	1%	8%	3%	30%	100%
2027	1.24	740	917.6	65%	25%	9%	25%	1%	8%	3%	30%	100%
2028	1.24	740	917.6	65%	25%	9%	25%	1%	8%	3%	30%	100%
2029	1.24	740	917.6	65%	25%	9%	25%	1%	8%	3%	30%	100%
2030	1.24	740	917.6	65%	25%	9%	25%	1%	8%	3%	30%	100%
2031	1.24	740	917.6	65%	25%	9%	25%	1%	8%	3%	30%	100%
2032	1.24	740	917.6	65%	25%	9%	25%	1%	8%	3%	30%	100%
2033	1.24	740	917.6	65%	25%	9%	25%	1%	8%	3%	30%	100%
2034	1.24	740	917.6	65%	25%	9%	25%	1%	8%	3%	30%	100%
2035	1.24	740	917.6	65%	25%	9%	25%	1%	8%	3%	30%	100%
2036	1.24	740	917.6	65%	25%	9%	25%	1%	8%	3%	30%	100%
2037	1.24	740	917.6	65%	25%	9%	25%	1%	8%	3%	30%	100%
2038	1.24	740	917.6	65%	25%	9%	25%	1%	8%	3%	30%	100%
2039	1.24	740	917.6	65%	25%	9%	25%	1%	8%	3%	30%	100%
2040	1.24	740	917.6	65%	25%	9%	25%	1%	8%	3%	30%	100%
2041	1.24	740	917.6	65%	25%	9%	25%	1%	8%	3%	30%	100%
2042			0									0%
2043			0									0%
2044			0									0%
2045			0									0%
2046			0									0%
2047			0									0%
2048			0									0%
2049			0									0%
2050			0									0%
2051			0									0%

Industrial waste activity data

Enter GDP, waste generation rate, % to SWDS and distribution of waste between site types into the yellow cells.
Help and default regional values are given in the 2006 IPCC Guidelines.

Year	GDP	Waste generation rate	Total industrial waste	% to SWDS	Total to SWDS
	$ millions	Gg/$m GDP/yr	Gg	%	Gg
2012			0	0%	0
2013			0	0%	0
2014			0	0%	0
2015			0	0%	0
2016			0	0%	0
2017			0	0%	0
2018			0	0%	0
2019			0	0%	0
2020			0	0%	0
2021			0	0%	0
2022			0	0%	0
2023			0	0%	0
2024			0	0%	0
2025			0	0%	0
2026			0	0%	0
2027			0	0%	0
2028			0	0%	0
2029			0	0%	0
2030			0	0%	0
2031			0	0%	0
2032			0	0%	0
2033			0	0%	0
2034			0	0%	0
2035			0	0%	0
2036			0	0%	0
2037			0	0%	0
2038			0	0%	0
2039			0	0%	0
2040			0	0%	0
2041			0	0%	0
2042			0	0%	0
2043			0	0%	0
2044			0	0%	0
2045			0	0%	0
2046			0	0%	0
2047			0	0%	0
2048			0	0%	0
2049			0	0%	0
2050			0	0%	0
2051			0	0%	0

2052			0								0%
2053			0								0%
2054			0								0%
2055			0								0%
2056			0								0%
2057			0								0%
2058			0								0%
2059			0								0%
2060			0								0%
2061			0								0%
2062			0								0%
2063			0								0%
2064			0								0%
2065			0								0%
2066			0								0%
2067			0								0%
2068			0								0%
2069			0								0%
2070			0								0%
2071			0								0%
2072			0								0%
2073			0								0%
2074			0								0%
2075			0								0%
2076			0								0%
2077			0								0%
2078			0								0%
2079			0								0%
2080			0								0%
2081			0								0%
2082			0								0%
2083			0								0%
2084			0								0%
2085			0								0%
2086			0								0%
2087			0								0%
2088			0								0%
2089			0								0%
2090			0								0%
2091			0								0%
2092			0								0%

2052			0	0%	0
2053			0	0%	0
2054			0	0%	0
2055			0	0%	0
2056			0	0%	0
2057			0	0%	0
2058			0	0%	0
2059			0	0%	0
2060			0	0%	0
2061			0	0%	0
2062			0	0%	0
2063			0	0%	0
2064			0	0%	0
2065			0	0%	0
2066			0	0%	0
2067			0	0%	0
2068			0	0%	0
2069			0	0%	0
2070			0	0%	0
2071			0	0%	0
2072			0	0%	0
2073			0	0%	0
2074			0	0%	0
2075			0	0%	0
2076			0	0%	0
2077			0	0%	0
2078			0	0%	0
2079			0	0%	0
2080			0	0%	0
2081			0	0%	0
2082			0	0%	0
2083			0	0%	0
2084			0	0%	0
2085			0	0%	0
2086			0	0%	0
2087			0	0%	0
2088			0	0%	0
2089			0	0%	0
2090			0	0%	0
2091			0	0%	0
2092			0	0%	0

MSW activity data

Enter population, waste per capita and MSW waste composition into the yellow cells.
Help and default regional values are given in the 2006 IPCC Guidelines.
Industrial waste activity data must be entered separately starting in Column Q.

IPCC Regional defaults

	560		47%	24%	0%	28%	11%	0%	0%	37%	100%
				Composition of waste going to solid waste disposal sites							
Year	Population	Waste per capita	Total MSW	% to SWDS	Food	Garden	Paper	Wood	Textile	Nappies	Plastics, other inert	Total
	millions	kg/cap/yr	Gg	%	%	%	%	%	%	%	%	(=100%)
2012	1.24	740	917.6	65%	25.0%	8.6%	24.7%	0.8%	8.1%	3.0%	29.9%	100%
2013	1.24	740	917.6	65%	22.9%	7.8%	22.8%	0.9%	9.1%	3.0%	33.6%	100%
2014	1.24	740	917.6	65%	20.7%	7.0%	21.0%	1.0%	10.2%	3.0%	37.2%	100%
2015	1.24	740	917.6	65%	18.6%	6.2%	19.2%	1.1%	11.2%	3.0%	40.8%	100%
2016	1.24	740	917.6	65%	16.4%	5.4%	17.3%	1.2%	12.3%	3.0%	44.5%	100%
2017	1.24	740	917.6	65%	14.3%	4.6%	15.5%	1.3%	13.4%	3.0%	48.1%	100%
2018	1.24	740	917.6	65%	12.1%	3.8%	13.6%	1.4%	14.4%	3.0%	51.8%	100%
2019	1.24	740	917.6	65%	10.0%	3.0%	11.8%	1.5%	15.5%	3.0%	55.4%	100%
2020	1.24	740	917.6	65%	7.6%	2.4%	10.0%	1.6%	16.6%	3.0%	59.0%	100%
2021	1.24	740	917.6	65%	8%	2%	10%	2%	17%	3%	59%	100%
2022	1.24	740	917.6	65%	8%	2%	10%	2%	17%	3%	59%	100%
2023	1.24	740	917.6	65%	8%	2%	10%	2%	17%	3%	59%	100%
2024	1.24	740	917.6	65%	8%	2%	10%	2%	17%	3%	59%	100%
2025	1.24	740	917.6	65%	8%	2%	10%	2%	17%	3%	59%	100%
2026	1.24	740	917.6	65%	8%	2%	10%	2%	17%	3%	59%	100%
2027	1.24	740	917.6	65%	8%	2%	10%	2%	17%	3%	59%	100%
2028	1.24	740	917.6	65%	8%	2%	10%	2%	17%	3%	59%	100%
2029	1.24	740	917.6	65%	8%	2%	10%	2%	17%	3%	59%	100%
2030	1.24	740	917.6	65%	8%	2%	10%	2%	17%	3%	59%	100%
2031	1.24	740	917.6	65%	8%	2%	10%	2%	17%	3%	59%	100%
2032	1.24	740	917.6	65%	8%	2%	10%	2%	17%	3%	59%	100%
2033	1.24	740	917.6	65%	8%	2%	10%	2%	17%	3%	59%	100%
2034	1.24	740	917.6	65%	8%	2%	10%	2%	17%	3%	59%	100%
2035	1.24	740	917.6	65%	8%	2%	10%	2%	17%	3%	59%	100%
2036	1.24	740	917.6	65%	8%	2%	10%	2%	17%	3%	59%	100%
2037	1.24	740	917.6	65%	8%	2%	10%	2%	17%	3%	59%	100%
2038	1.24	740	917.6	65%	8%	2%	10%	2%	17%	3%	59%	100%
2039	1.24	740	917.6	65%	8%	2%	10%	2%	17%	3%	59%	100%
2040	1.24	740	917.6	65%	8%	2%	10%	2%	17%	3%	59%	100%
2041	1.24	740	917.6	65%	8%	2%	10%	2%	17%	3%	59%	100%
2042			0									0%
2043			0									0%
2044			0									0%
2045			0									0%
2046			0									0%
2047			0									0%
2048			0									0%
2049			0									0%
2050			0									0%
2051			0									0%

Industrial waste activity data

Enter GDP, waste generation rate, % to SWDS and distribution of waste between site types into the yellow cells.
Help and default regional values are given in the 2006 IPCC Guidelines.

Year	GDP	Waste generation rate	Total industrial waste	% to SWDS	Total to SWDS
	$ millions	Gg/$m GDP/yr	Gg	%	Gg
2012			0	0%	0
2013			0	0%	0
2014			0	0%	0
2015			0	0%	0
2016			0	0%	0
2017			0	0%	0
2018			0	0%	0
2019			0	0%	0
2020			0	0%	0
2021			0	0%	0
2022			0	0%	0
2023			0	0%	0
2024			0	0%	0
2025			0	0%	0
2026			0	0%	0
2027			0	0%	0
2028			0	0%	0
2029			0	0%	0
2030			0	0%	0
2031			0	0%	0
2032			0	0%	0
2033			0	0%	0
2034			0	0%	0
2035			0	0%	0
2036			0	0%	0
2037			0	0%	0
2038			0	0%	0
2039			0	0%	0
2040			0	0%	0
2041			0	0%	0
2042			0	0%	0
2043			0	0%	0
2044			0	0%	0
2045			0	0%	0
2046			0	0%	0
2047			0	0%	0
2048			0	0%	0
2049			0	0%	0
2050			0	0%	0
2051			0	0%	0

2052			0								0%	2052			0	0%	0
2053			0								0%	2053			0	0%	0
2054			0								0%	2054			0	0%	0
2055			0								0%	2055			0	0%	0
2056			0								0%	2056			0	0%	0
2057			0								0%	2057			0	0%	0
2058			0								0%	2058			0	0%	0
2059			0								0%	2059			0	0%	0
2060			0								0%	2060			0	0%	0
2061			0								0%	2061			0	0%	0
2062			0								0%	2062			0	0%	0
2063			0								0%	2063			0	0%	0
2064			0								0%	2064			0	0%	0
2065			0								0%	2065			0	0%	0
2066			0								0%	2066			0	0%	0
2067			0								0%	2067			0	0%	0
2068			0								0%	2068			0	0%	0
2069			0								0%	2069			0	0%	0
2070			0								0%	2070			0	0%	0
2071			0								0%	2071			0	0%	0
2072			0								0%	2072			0	0%	0
2073			0								0%	2073			0	0%	0
2074			0								0%	2074			0	0%	0
2075			0								0%	2075			0	0%	0
2076			0								0%	2076			0	0%	0
2077			0								0%	2077			0	0%	0
2078			0								0%	2078			0	0%	0
2079			0								0%	2079			0	0%	0
2080			0								0%	2080			0	0%	0
2081			0								0%	2081			0	0%	0
2082			0								0%	2082			0	0%	0
2083			0								0%	2083			0	0%	0
2084			0								0%	2084			0	0%	0
2085			0								0%	2085			0	0%	0
2086			0								0%	2086			0	0%	0
2087			0								0%	2087			0	0%	0
2088			0								0%	2088			0	0%	0
2089			0								0%	2089			0	0%	0
2090			0								0%	2090			0	0%	0
2091			0								0%	2091			0	0%	0
2092			0								0%	2092			0	0%	0

MSW activity data

Enter population, waste per capita and MSW waste composition into the yellow cells.
Help and default regional values are given in the 2006 IPCC Guidelines.
Industrial waste activity data must be entered separately starting in Column Q.

Year	Population	Waste per capita	Total MSW	% to SWDS	Food	Garden	Paper	Wood	Textile	Nappies	Sludge	Plastics, other inert	Total
IPCC Regional defaults		560		47%	24%	0%	28%	11%	0%	0%		37%	100%
					Composition of waste going to solid waste disposal sites								
	millions	kg/cap/yr	Gg	%	%	%	%	%	%	%	%	%	(=100%)
2012	1.24	740	917.6	65%	24%	7%	21%	1%	7%	3%	13%	23%	100%
2013	1.24	740	917.6	65%	24%	7%	21%	1%	7%	3%	13%	23%	100%
2014	1.24	740	917.6	65%	24%	7%	21%	1%	7%	3%	13%	23%	100%
2015	1.24	740	917.6	65%	24%	7%	21%	1%	7%	3%	13%	23%	100%
2016	1.24	740	917.6	65%	24%	7%	21%	1%	7%	3%	13%	23%	100%
2017	1.24	740	917.6	65%	24%	7%	21%	1%	7%	3%	13%	23%	100%
2018	1.24	740	917.6	65%	24%	7%	21%	1%	7%	3%	13%	23%	100%
2019	1.24	740	917.6	65%	24%	7%	21%	1%	7%	3%	13%	23%	100%
2020	1.24	740	917.6	65%	24%	7%	21%	1%	7%	3%	13%	23%	100%
2021	1.24	740	917.6	65%	24%	7%	21%	1%	7%	3%	13%	23%	100%
2022	1.24	740	917.6	65%	24%	7%	21%	1%	7%	3%	13%	23%	100%
2023	1.24	740	917.6	65%	24%	7%	21%	1%	7%	3%	13%	23%	100%
2024	1.24	740	917.6	65%	24%	7%	21%	1%	7%	3%	13%	23%	100%
2025	1.24	740	917.6	65%	24%	7%	21%	1%	7%	3%	13%	23%	100%
2026	1.24	740	917.6	65%	24%	7%	21%	1%	7%	3%	13%	23%	100%
2027	1.24	740	917.6	65%	24%	7%	21%	1%	7%	3%	13%	23%	100%
2028	1.24	740	917.6	65%	24%	7%	21%	1%	7%	3%	13%	23%	100%
2029	1.24	740	917.6	65%	24%	7%	21%	1%	7%	3%	13%	23%	100%
2030	1.24	740	917.6	65%	24%	7%	21%	1%	7%	3%	13%	23%	100%
2031	1.24	740	917.6	65%	24%	7%	21%	1%	7%	3%	13%	23%	100%
2032	1.24	740	917.6	65%	24%	7%	21%	1%	7%	3%	13%	23%	100%
2033	1.24	740	917.6	65%	24%	7%	21%	1%	7%	3%	13%	23%	100%
2034	1.24	740	917.6	65%	24%	7%	21%	1%	7%	3%	13%	23%	100%
2035	1.24	740	917.6	65%	24%	7%	21%	1%	7%	3%	13%	23%	100%
2036	1.24	740	917.6	65%	24%	7%	21%	1%	7%	3%	13%	23%	100%
2037	1.24	740	917.6	65%	24%	7%	21%	1%	7%	3%	13%	23%	100%
2038	1.24	740	917.6	65%	24%	7%	21%	1%	7%	3%	13%	23%	100%
2039	1.24	740	917.6	65%	24%	7%	21%	1%	7%	3%	13%	23%	100%
2040	1.24	740	917.6	65%	24%	7%	21%	1%	7%	3%	13%	23%	100%
2041	1.24	740	917.6	65%	24%	7%	21%	1%	7%	3%	13%	23%	100%
2042			0										0%
2043			0										0%
2044			0										0%
2045			0										0%
2046			0										0%
2047			0										0%
2048			0										0%
2049			0										0%
2050			0										0%
2051			0										0%
2052			0										0%
2053			0										0%
2054			0										0%

Industrial waste activity data

Enter GDP, waste generation rate, % to SWDS and distribution of waste between site types into the yellow cells.
Help and default regional values are given in the 2006 IPCC Guidelines.

Year	GDP	Waste generation rate	Total industrial waste	% to SWDS	Total to SWDS
	$ millions	Gg/$m GDP/yr	Gg	%	Gg
2012			0	0%	0
2013			0	0%	0
2014			0	0%	0
2015			0	0%	0
2016			0	0%	0
2017			0	0%	0
2018			0	0%	0
2019			0	0%	0
2020			0	0%	0
2021			0	0%	0
2022			0	0%	0
2023			0	0%	0
2024			0	0%	0
2025			0	0%	0
2026			0	0%	0
2027			0	0%	0
2028			0	0%	0
2029			0	0%	0
2030			0	0%	0
2031			0	0%	0
2032			0	0%	0
2033			0	0%	0
2034			0	0%	0
2035			0	0%	0
2036			0	0%	0
2037			0	0%	0
2038			0	0%	0
2039			0	0%	0
2040			0	0%	0
2041			0	0%	0
2042			0	0%	0
2043			0	0%	0
2044			0	0%	0
2045			0	0%	0
2046			0	0%	0
2047			0	0%	0
2048			0	0%	0
2049			0	0%	0
2050			0	0%	0
2051			0	0%	0
2052			0	0%	0
2053			0	0%	0
2054			0	0%	0

2055			0									0%
2056			0									0%
2057			0									0%
2058			0									0%
2059			0									0%
2060			0									0%
2061			0									0%
2062			0									0%
2063			0									0%
2064			0									0%
2065			0									0%
2066			0									0%
2067			0									0%
2068			0									0%
2069			0									0%
2070			0									0%
2071			0									0%
2072			0									0%
2073			0									0%
2074			0									0%
2075			0									0%
2076			0									0%
2077			0									0%
2078			0									0%
2079			0									0%
2080			0									0%
2081			0									0%
2082			0									0%
2083			0									0%
2084			0									0%
2085			0									0%
2086			0									0%
2087			0									0%
2088			0									0%
2089			0									0%
2090			0									0%
2091			0									0%
2092			0									0%

2055			0	0%	0
2056			0	0%	0
2057			0	0%	0
2058			0	0%	0
2059			0	0%	0
2060			0	0%	0
2061			0	0%	0
2062			0	0%	0
2063			0	0%	0
2064			0	0%	0
2065			0	0%	0
2066			0	0%	0
2067			0	0%	0
2068			0	0%	0
2069			0	0%	0
2070			0	0%	0
2071			0	0%	0
2072			0	0%	0
2073			0	0%	0
2074			0	0%	0
2075			0	0%	0
2076			0	0%	0
2077			0	0%	0
2078			0	0%	0
2079			0	0%	0
2080			0	0%	0
2081			0	0%	0
2082			0	0%	0
2083			0	0%	0
2084			0	0%	0
2085			0	0%	0
2086			0	0%	0
2087			0	0%	0
2088			0	0%	0
2089			0	0%	0
2090			0	0%	0
2091			0	0%	0
2092			0	0%	0

Amount deposited data **Country** Ireland

Countries with good inventory data:
Enter those data onto this sheet.

	Amounts deposited in SWDS									
Year	Food	Garden	Paper	Wood	Textile	Nappies	Sludge	Deposited MSW	Inert	Industrial
	Gg	Gg	Gg	Gg	Gg	Gg	Gg	Gg	Gg	Gg
2012	150	52	148	5	48	18	0	600	180	0
2013	150	52	148	5	48	18	0	600	180	0
2014	150	52	148	5	48	18	0	600	180	0
2015	150	52	148	5	48	18	0	600	180	0
2016	150	52	148	5	48	18	0	600	180	0
2017	150	52	148	5	48	18	0	600	180	0
2018	150	52	148	5	48	18	0	600	180	0
2019	150	52	148	5	48	18	0	600	180	0
2020	150	52	148	5	48	18	0	600	180	0
2021	150	52	148	5	48	18	0	600	180	0
2022	150	52	148	5	48	18	0	600	180	0
2023	150	52	148	5	48	18	0	600	180	0
2024	150	52	148	5	48	18	0	600	180	0
2025	150	52	148	5	48	18	0	600	180	0
2026	150	52	148	5	48	18	0	600	180	0
2027	150	52	148	5	48	18	0	600	180	0
2028	150	52	148	5	48	18	0	600	180	0
2029	150	52	148	5	48	18	0	600	180	0
2030	150	52	148	5	48	18	0	600	180	0
2031	150	52	148	5	48	18	0	600	180	0
2032	150	52	148	5	48	18	0	600	180	0
2033	150	52	148	5	48	18	0	600	180	0
2034	150	52	148	5	48	18	0	600	180	0
2035	150	52	148	5	48	18	0	600	180	0
2036	150	52	148	5	48	18	0	600	180	0
2037	150	52	148	5	48	18	0	600	180	0
2038	150	52	148	5	48	18	0	600	180	0
2039	150	52	148	5	48	18	0	600	180	0
2040	150	52	148	5	48	18	0	600	180	0
2041	150	52	148	5	48	18	0	600	180	0
2042	0	0	0	0	0	0	0	0	0	0
2043	0	0	0	0	0	0	0	0	0	0
2044	0	0	0	0	0	0	0	0	0	0
2045	0	0	0	0	0	0	0	0	0	0
2046	0	0	0	0	0	0	0	0	0	0
2047	0	0	0	0	0	0	0	0	0	0
2048	0	0	0	0	0	0	0	0	0	0
2049	0	0	0	0	0	0	0	0	0	0
2050	0	0	0	0	0	0	0	0	0	0
2051	0	0	0	0	0	0	0	0	0	0
2052	0	0	0	0	0	0	0	0	0	0
2053	0	0	0	0	0	0	0	0	0	0
2054	0	0	0	0	0	0	0	0	0	0
2055	0	0	0	0	0	0	0	0	0	0
2056	0	0	0	0	0	0	0	0	0	0
2057	0	0	0	0	0	0	0	0	0	0
2058	0	0	0	0	0	0	0	0	0	0
2059	0	0	0	0	0	0	0	0	0	0
2060	0	0	0	0	0	0	0	0	0	0
2061	0	0	0	0	0	0	0	0	0	0
2062	0	0	0	0	0	0	0	0	0	0
2063	0	0	0	0	0	0	0	0	0	0
2064	0	0	0	0	0	0	0	0	0	0
2065	0	0	0	0	0	0	0	0	0	0
2066	0	0	0	0	0	0	0	0	0	0
2067	0	0	0	0	0	0	0	0	0	0
2068	0	0	0	0	0	0	0	0	0	0
2069	0	0	0	0	0	0	0	0	0	0
2070	0	0	0	0	0	0	0	0	0	0
2071	0	0	0	0	0	0	0	0	0	0
2072	0	0	0	0	0	0	0	0	0	0
2073	0	0	0	0	0	0	0	0	0	0
2074	0	0	0	0	0	0	0	0	0	0
2075	0	0	0	0	0	0	0	0	0	0
2076	0	0	0	0	0	0	0	0	0	0
2077	0	0	0	0	0	0	0	0	0	0
2078	0	0	0	0	0	0	0	0	0	0
2079	0	0	0	0	0	0	0	0	0	0
2080	0	0	0	0	0	0	0	0	0	0
2081	0	0	0	0	0	0	0	0	0	0
2082	0	0	0	0	0	0	0	0	0	0
2083	0	0	0	0	0	0	0	0	0	0
2084	0	0	0	0	0	0	0	0	0	0
2085	0	0	0	0	0	0	0	0	0	0
2086	0	0	0	0	0	0	0	0	0	0
2087	0	0	0	0	0	0	0	0	0	0
2088	0	0	0	0	0	0	0	0	0	0
2089	0	0	0	0	0	0	0	0	0	0
2090	0	0	0	0	0	0	0	0	0	0
2091	0	0	0	0	0	0	0	0	0	0
2092	0	0	0	0	0	0	0	0	0	0

Methane Recovery and methane oxidised in top layer (OX)

Enter the total amount of methane recovered from all SWDS.

	Amount of Methane Recovered from SWDS	References / remarks	Fraction recovered methane	Methane oxidised (OX)	References/remarks
IPCC default	0			0	
Year	Gg			Fraction	
2012	0.0		0.00	0.10	
2013	2.3		0.75	0.10	
2014	4.4		0.75	0.10	
2015	6.3		0.75	0.10	
2016	8.0		0.75	0.10	
2017	9.5		0.75	0.10	
2018	10.9		0.75	0.10	
2019	12.1		0.75	0.10	
2020	13.2		0.75	0.10	
2021	14.2		0.75	0.10	
2022	15.2		0.75	0.10	
2023	16.0		0.75	0.10	
2024	16.8		0.75	0.10	
2025	17.5		0.75	0.10	
2026	18.2		0.75	0.10	
2027	18.8		0.75	0.10	
2028	19.4		0.75	0.10	
2029	19.9		0.75	0.10	
2030	20.4		0.75	0.10	
2031	20.8		0.75	0.10	
2032	21.3		0.75	0.10	
2033	21.6		0.75	0.10	
2034	22.0		0.75	0.10	
2035	22.3		0.75	0.10	
2036	22.7		0.75	0.10	
2037	23.0		0.75	0.10	
2038	23.2		0.75	0.10	
2039	23.5		0.75	0.10	
2040	23.7		0.75	0.10	
2041	24.0		0.75	0.10	
2042	24.2		0.75	0.10	
2043	22.0		0.75	0.10	
2044	20.1		0.75	0.10	
2045	18.4		0.75	0.10	
2046	16.9		0.75	0.10	
2047	15.5		0.75	0.10	
2048	14.3		0.75	0.10	
2049	13.2		0.75	0.10	
2050	12.2		0.75	0.10	
2051	11.3		0.75	0.10	
2052	10.5		0.75	0.10	
2053	9.7		0.75	0.10	
2054	9.1		0.75	0.10	
2055	8.4		0.75	0.10	
2056	7.9		0.75	0.10	
2057	7.3		0.75	0.10	
2058	6.8		0.75	0.10	
2059	6.4		0.75	0.10	
2060	6.0		0.75	0.10	
2061	5.6		0.75	0.10	
2062	5.2		0.75	0.10	
2063	4.9		0.75	0.10	
2064	4.6		0.75	0.10	
2065	4.3		0.75	0.10	
2066	4.0		0.75	0.10	
2067	3.8		0.75	0.10	
2068	3.5		0.75	0.10	
2069	3.3		0.75	0.10	
2070	3.1		0.75	0.10	
2071	2.9		0.75	0.10	
2072	2.8		0.75	0.10	
2073	2.6		0.75	0.10	
2074	2.4		0.75	0.10	
2075	2.3		0.75	0.10	
2076	2.2		0.75	0.10	
2077	2.0		0.75	0.10	
2078	1.9		0.75	0.10	
2079	1.8		0.75	0.10	
2080	1.7		0.75	0.10	
2081	1.6		0.75	0.10	
2082	1.5		0.75	0.10	
2083	1.4		0.75	0.10	
2084	1.3		0.75	0.10	
2085	1.3		0.75	0.10	
2086	1.2		0.75	0.10	
2087	1.1		0.75	0.10	
2088	1.0		0.75	0.10	
2089	1.0		0.75	0.10	
2090	0.9		0.75	0.10	
2091	0.9		0.75	0.10	
2092	0.8		0.75	0.10	

Results

Country
Ireland

Enter starting year, industrial waste disposal data and methane recovery into the yellow cells.
MSW activity data is entered on MSW sheet

											22,699	17,025	5,107	
Sum	225	103	580	18	113	43	0	0	0	1,081	811	243	5,107	

	Methane generated												
Year	**Food**	**Garden**	**Paper**	**Wood**	**Textile**	**Nappies**	**Sludge**	**MSW**	**Industrial**	**Total**	**Methane recovery**	**Methane emission**	
	A	B	C	D	E	F	G	H	J	K	L	M = (K-L)*(1-OX)	
	Gg	Gg	Gg	Gg	Gg	Gg	Gg	Gg	Gg	Gg	Gg	Gg	
2012	0	0	0	0	0	0	0		0	0	0	0	0
2013	1	0	1	0	0	0	0		0	3	2	1	14.76987
2014	2	1	2	0	0	0	0		0	6	4	1	27.93899
2015	3	1	3	0	1	0	0		0	8	6	2	39.72007
2016	4	1	4	0	1	0	0		0	11	8	2	50.29382
2017	5	1	5	0	1	1	0		0	13	9	3	59.81406
2018	5	2	6	0	1	1	0		0	14	11	3	68.412
2019	5	2	7	0	1	1	0		0	16	12	4	76.19981
2020	6	2	8	0	1	1	0		0	18	13	4	83.27364
2021	6	2	8	0	2	1	0		0	19	14	4	89.71611
2022	6	2	9	0	2	1	0		0	20	15	5	95.59838
2023	7	2	10	0	2	1	0		0	21	16	5	100.9819
2024	7	2	10	0	2	1	0		0	22	17	5	105.9201
2025	7	3	11	0	2	1	0		0	23	18	5	110.4591
2026	7	3	11	0	2	1	0		0	24	18	5	114.6393
2027	7	3	12	0	2	1	0		0	25	19	6	118.4962
2028	7	3	12	0	2	1	0		0	26	19	6	122.0605
2029	7	3	13	0	2	1	0		0	27	20	6	125.3597
2030	7	3	13	0	3	1	0		0	27	20	6	128.4177
2031	7	3	13	0	3	1	0		0	28	21	6	131.256
2032	7	3	14	0	3	1	0		0	28	21	6	133.8935
2033	7	3	14	0	3	1	0		0	29	22	6	136.3472
2034	7	3	14	0	3	1	0		0	29	22	7	138.6321
2035	7	3	15	0	3	1	0		0	30	22	7	140.7619
2036	7	3	15	0	3	1	0		0	30	23	7	142.7488
2037	7	3	15	0	3	1	0		0	31	23	7	144.6038
2038	7	3	16	0	3	1	0		0	31	23	7	146.337
2039	7	3	16	0	3	1	0		0	31	23	7	147.9575
2040	7	3	16	0	3	1	0		0	32	24	7	149.4734
2041	7	3	16	0	3	1	0		0	32	24	7	150.8923
2042	7	3	16	0	3	1	0		0	32	24	7	152.2211
2043	6	3	16	0	3	1	0		0	29	22	7	138.6963
2044	5	3	15	0	3	1	0		0	27	20	6	126.6942
2045	4	2	14	0	3	1	0		0	25	18	6	116.0075
2046	4	2	13	0	3	1	0		0	23	17	5	106.4604
2047	3	2	12	0	2	1	0		0	21	16	5	97.90352
2048	2	2	12	0	2	1	0		0	19	14	4	90.20994
2049	2	2	11	0	2	1	0		0	18	13	4	83.2713
2050	2	1	10	0	2	1	0		0	16	12	4	76.99507
2051	1	1	10	0	2	1	0		0	15	11	3	71.30196
2052	1	1	9	0	2	1	0		0	14	10	3	66.12388
2053	1	1	9	0	2	0	0		0	13	10	3	61.40224
2054	1	1	8	0	2	0	0		0	12	9	3	57.08641
2055	1	1	8	0	1	0	0		0	11	8	3	53.13259
2056	1	1	7	0	1	0	0		0	10	8	2	49.50274
2057	0	1	7	0	1	0	0		0	10	7	2	46.1637
2058	0	1	6	0	1	0	0		0	9	7	2	43.08652
2059	0	1	6	0	1	0	0		0	9	6	2	40.24581
2060	0	1	6	0	1	0	0		0	8	6	2	37.61926
2061	0	0	5	0	1	0	0		0	7	6	2	35.18716
2062	0	0	5	0	1	0	0		0	7	5	2	32.93209
2063	0	0	5	0	1	0	0		0	7	5	1	30.83856
2064	0	0	4	0	1	0	0		0	6	5	1	28.89278
2065	0	0	4	0	1	0	0		0	6	4	1	27.08244
2066	0	0	4	0	1	0	0		0	5	4	1	25.39647
2067	0	0	4	0	1	0	0		0	5	4	1	23.82495
2068	0	0	3	0	1	0	0		0	5	4	1	22.35891
2069	0	0	3	0	1	0	0		0	4	3	1	20.99027
2070	0	0	3	0	1	0	0		0	4	3	1	19.71168
2071	0	0	3	0	1	0	0		0	4	3	1	18.51646
2072	0	0	3	0	1	0	0		0	4	3	1	17.39854
2073	0	0	3	0	0	0	0		0	3	3	1	16.35235
2074	0	0	2	0	0	0	0		0	3	2	1	15.37282
2075	0	0	2	0	0	0	0		0	3	2	1	14.4553
2076	0	0	2	0	0	0	0		0	3	2	1	13.59549
2077	0	0	2	0	0	0	0		0	3	2	1	12.78945
2078	0	0	2	0	0	0	0		0	3	2	1	12.03356
2079	0	0	2	0	0	0	0		0	2	2	1	11.32446
2080	0	0	2	0	0	0	0		0	2	2	1	10.65904
2081	0	0	2	0	0	0	0		0	2	2	0	10.03445
2082	0	0	1	0	0	0	0		0	2	1	0	9.448009
2083	0	0	1	0	0	0	0		0	2	1	0	8.897259
2084	0	0	1	0	0	0	0		0	2	1	0	8.379902
2085	0	0	1	0	0	0	0		0	2	1	0	7.893807
2086	0	0	1	0	0	0	0		0	2	1	0	7.436989
2087	0	0	1	0	0	0	0		0	1	1	0	7.007601
2088	0	0	1	0	0	0	0		0	1	1	0	6.603919
2089	0	0	1	0	0	0	0		0	1	1	0	6.224337
2090	0	0	1	0	0	0	0		0	1	1	0	5.867355
2091	0	0	1	0	0	0	0		0	1	1	0	5.531574
2092	0	0	1	0	0	0	0		0	1	1	0	5.215686

Results - 600000 tonnes

Country
Ireland

sum	**225**	**103**	**580**	**18**	**113**	**43**	**1081**	**811**	**243.21**	**Gg CH4**
							22699	**17025**	**5107.4**	**Gg CO2 Equivalent**

Year	Methane generated Food A Gg	Garden B Gg	Paper C Gg	Wood D Gg	Textile E Gg	Nappies F Gg	Total K Gg	Methane recc L Gg	Methane emission M = (K-L)*(1-OX) Gg	
2012	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2013	1.27	0.33	1.15	0.02	0.22	0.14	3.13	2.34	0.70	14.77
2014	2.32	0.62	2.23	0.04	0.43	0.26	5.91	4.43	1.33	27.94
2015	3.19	0.89	3.26	0.06	0.63	0.37	8.41	6.30	1.89	39.72
2016	3.92	1.13	4.22	0.08	0.82	0.47	10.64	7.98	2.39	50.29
2017	4.53	1.35	5.12	0.10	1.00	0.57	12.66	9.49	2.85	59.81
2018	5.03	1.55	5.97	0.11	1.16	0.65	14.48	10.86	3.26	68.41
2019	5.45	1.73	6.78	0.13	1.32	0.72	16.13	12.10	3.63	76.20
2020	5.79	1.89	7.53	0.15	1.46	0.79	17.62	13.22	3.97	83.27
2021	6.08	2.04	8.25	0.16	1.60	0.85	18.99	14.24	4.27	89.72
2022	6.32	2.17	8.92	0.18	1.73	0.91	20.23	15.17	4.55	95.60
2023	6.52	2.29	9.55	0.19	1.86	0.96	21.37	16.03	4.81	100.98
2024	6.69	2.40	10.14	0.21	1.97	1.01	22.42	16.81	5.04	105.92
2025	6.82	2.50	10.70	0.22	2.08	1.05	23.38	17.53	5.26	110.46
2026	6.94	2.59	11.23	0.24	2.18	1.08	24.26	18.20	5.46	114.64
2027	7.03	2.67	11.73	0.25	2.28	1.12	25.08	18.81	5.64	118.50
2028	7.11	2.75	12.19	0.26	2.37	1.15	25.83	19.37	5.81	122.06
2029	7.18	2.81	12.64	0.27	2.46	1.18	26.53	19.90	5.97	125.36
2030	7.23	2.87	13.05	0.29	2.54	1.20	27.18	20.38	6.12	128.42
2031	7.28	2.93	13.44	0.30	2.61	1.22	27.78	20.83	6.25	131.26
2032	7.31	2.97	13.81	0.31	2.68	1.25	28.34	21.25	6.38	133.89
2033	7.35	3.02	14.16	0.32	2.75	1.26	28.86	21.64	6.49	136.35
2034	7.37	3.06	14.48	0.33	2.81	1.28	29.34	22.01	6.60	138.63
2035	7.39	3.10	14.79	0.34	2.87	1.30	29.79	22.34	6.70	140.76
2036	7.41	3.13	15.08	0.35	2.93	1.31	30.21	22.66	6.80	142.75
2037	7.43	3.16	15.35	0.36	2.98	1.32	30.60	22.95	6.89	144.60
2038	7.44	3.18	15.61	0.37	3.03	1.33	30.97	23.23	6.97	146.34
2039	7.45	3.21	15.85	0.38	3.08	1.34	31.31	23.49	7.05	147.96
2040	7.46	3.23	16.08	0.39	3.12	1.35	31.63	23.73	7.12	149.47
2041	7.47	3.25	16.29	0.40	3.17	1.36	31.93	23.95	7.19	150.89
2042	7.47	3.27	16.49	0.41	3.21	1.37	32.22	24.16	7.25	152.22
2043	6.21	2.96	15.53	0.40	3.02	1.24	29.35	22.03	6.60	138.70
2044	5.16	2.68	14.63	0.38	2.84	1.12	26.81	20.11	6.03	126.69
2045	4.29	2.42	13.78	0.37	2.68	1.01	24.55	18.41	5.52	116.01
2046	3.56	2.19	12.97	0.36	2.52	0.92	22.53	16.90	5.07	106.46
2047	2.96	1.98	12.22	0.35	2.37	0.83	20.72	15.54	4.66	97.90
2048	2.46	1.79	11.51	0.34	2.24	0.75	19.09	14.32	4.30	90.21
2049	2.05	1.62	10.84	0.33	2.11	0.68	17.62	13.22	3.97	83.27
2050	1.70	1.47	10.21	0.32	1.98	0.61	16.30	12.22	3.67	77.00
2051	1.41	1.33	9.61	0.31	1.87	0.56	15.09	11.32	3.40	71.30
2052	1.17	1.20	9.05	0.30	1.76	0.50	13.99	10.50	3.15	66.12
2053	0.98	1.09	8.53	0.29	1.66	0.46	13.00	9.75	2.92	61.40
2054	0.81	0.98	8.03	0.28	1.56	0.41	12.08	9.06	2.72	57.09
2055	0.67	0.89	7.56	0.28	1.47	0.37	11.24	8.43	2.53	53.13
2056	0.56	0.81	7.12	0.27	1.38	0.34	10.48	7.86	2.36	49.50
2057	0.47	0.73	6.71	0.26	1.30	0.31	9.77	7.33	2.20	46.16
2058	0.39	0.66	6.32	0.25	1.23	0.28	9.12	6.84	2.05	43.09
2059	0.32	0.60	5.95	0.25	1.16	0.25	8.52	6.39	1.92	40.25
2060	0.27	0.54	5.60	0.24	1.09	0.23	7.96	5.97	1.79	37.62
2061	0.22	0.49	5.28	0.23	1.03	0.20	7.45	5.59	1.68	35.19
2062	0.18	0.44	4.97	0.22	0.97	0.19	6.97	5.23	1.57	32.93
2063	0.15	0.40	4.68	0.22	0.91	0.17	6.53	4.90	1.47	30.84
2064	0.13	0.36	4.41	0.21	0.86	0.15	6.11	4.59	1.38	28.89
2065	0.11	0.33	4.15	0.20	0.81	0.14	5.73	4.30	1.29	27.08
2066	0.09	0.30	3.91	0.20	0.76	0.12	5.37	4.03	1.21	25.40
2067	0.07	0.27	3.68	0.19	0.72	0.11	5.04	3.78	1.13	23.82
2068	0.06	0.24	3.47	0.19	0.67	0.10	4.73	3.55	1.06	22.36
2069	0.05	0.22	3.26	0.18	0.63	0.09	4.44	3.33	1.00	20.99
2070	0.04	0.20	3.07	0.18	0.60	0.08	4.17	3.13	0.94	19.71
2071	0.03	0.18	2.90	0.17	0.56	0.08	3.92	2.94	0.88	18.52
2072	0.03	0.16	2.73	0.17	0.53	0.07	3.68	2.76	0.83	17.40
2073	0.02	0.15	2.57	0.16	0.50	0.06	3.46	2.60	0.78	16.35
2074	0.02	0.13	2.42	0.16	0.47	0.06	3.25	2.44	0.73	15.37
2075	0.02	0.12	2.28	0.15	0.44	0.05	3.06	2.29	0.69	14.46
2076	0.01	0.11	2.14	0.15	0.42	0.05	2.88	2.16	0.65	13.60
2077	0.01	0.10	2.02	0.14	0.39	0.04	2.71	2.03	0.61	12.79
2078	0.01	0.09	1.90	0.14	0.37	0.04	2.55	1.91	0.57	12.03
2079	0.01	0.08	1.79	0.13	0.35	0.03	2.40	1.80	0.54	11.32
2080	0.01	0.07	1.69	0.13	0.33	0.03	2.26	1.69	0.51	10.66
2081	0.01	0.07	1.59	0.13	0.31	0.03	2.12	1.59	0.48	10.03
2082	0.00	0.06	1.50	0.12	0.29	0.03	2.00	1.50	0.45	9.45
2083	0.00	0.05	1.41	0.12	0.27	0.02	1.88	1.41	0.42	8.90
2084	0.00	0.05	1.33	0.12	0.26	0.02	1.77	1.33	0.40	8.38
2085	0.00	0.04	1.25	0.11	0.24	0.02	1.67	1.25	0.38	7.89
2086	0.00	0.04	1.18	0.11	0.23	0.02	1.57	1.18	0.35	7.44
2087	0.00	0.04	1.11	0.11	0.22	0.02	1.48	1.11	0.33	7.01
2088	0.00	0.03	1.04	0.10	0.20	0.01	1.40	1.05	0.31	6.60
2089	0.00	0.03	0.98	0.10	0.19	0.01	1.32	0.99	0.30	6.22
2090	0.00	0.03	0.93	0.10	0.18	0.01	1.24	0.93	0.28	5.87
2091	0.00	0.02	0.87	0.09	0.17	0.01	1.17	0.88	0.26	5.53
2092	0.00	0.02	0.82	0.09	0.16	0.01	1.10	0.83	0.25	5.22

Assumptions

Time period	80	years
Operational Period	30	years
% To Landfill	0.6539	
Tonnage	600000	tonnes
DOC	IPPC Default	
Population	1.24 million	
Waste/capita	740	kg/cap/yr
% Garden Waste	0.086	(source RPS/DCC 2005 Report)
Composition	as per	National Waste 2005 Report
Oxidation	0.1	
Wet Temperate	zone	

Country	Ireland

Long-term stored C in SWDS

In this sheet carbon long-term stored C in SWDS is calculated.

DOC:					
MSW	0	Food waste	0.15	Nappies	0.24
Paper	0.4	Garden	0.2	Sludge	0.05
Wood	0.43	Textiles	0.24	Industry	0.15

CO2 LTS	6,050
Carbon LTS	1,650

Year	MSW	Food	Garden	Paper	Wood	Textiles	Nappies	Sludge	C, Industry	Paper, industry subtotal	Wood, industry subtotal	Long-term stored C	Long-term stored C accumulated
	Gg	Gg	Gg	Gg	Gg	Gg	Gg	Gg	Gg	Gg	Gg	Gg	Gg
2012	0	11	5	30	1	6	2	0	0	0	0	55	55
2013	0	11	5	30	1	6	2	0	0	0	0	55	110
2014	0	11	5	30	1	6	2	0	0	0	0	55	165
2015	0	11	5	30	1	6	2	0	0	0	0	55	220
2016	0	11	5	30	1	6	2	0	0	0	0	55	275
2017	0	11	5	30	1	6	2	0	0	0	0	55	330
2018	0	11	5	30	1	6	2	0	0	0	0	55	385
2019	0	11	5	30	1	6	2	0	0	0	0	55	440
2020	0	11	5	30	1	6	2	0	0	0	0	55	495
2021	0	11	5	30	1	6	2	0	0	0	0	55	550
2022	0	11	5	30	1	6	2	0	0	0	0	55	605
2023	0	11	5	30	1	6	2	0	0	0	0	55	660
2024	0	11	5	30	1	6	2	0	0	0	0	55	715
2025	0	11	5	30	1	6	2	0	0	0	0	55	770
2026	0	11	5	30	1	6	2	0	0	0	0	55	825
2027	0	11	5	30	1	6	2	0	0	0	0	55	880
2028	0	11	5	30	1	6	2	0	0	0	0	55	935
2029	0	11	5	30	1	6	2	0	0	0	0	55	990
2030	0	11	5	30	1	6	2	0	0	0	0	55	1,045
2031	0	11	5	30	1	6	2	0	0	0	0	55	1,100
2032	0	11	5	30	1	6	2	0	0	0	0	55	1,155
2033	0	11	5	30	1	6	2	0	0	0	0	55	1,210
2034	0	11	5	30	1	6	2	0	0	0	0	55	1,265
2035	0	11	5	30	1	6	2	0	0	0	0	55	1,320
2036	0	11	5	30	1	6	2	0	0	0	0	55	1,375
2037	0	11	5	30	1	6	2	0	0	0	0	55	1,430
2038	0	11	5	30	1	6	2	0	0	0	0	55	1,485
2039	0	11	5	30	1	6	2	0	0	0	0	55	1,540
2040	0	11	5	30	1	6	2	0	0	0	0	55	1,595
2041	0	11	5	30	1	6	2	0	0	0	0	55	1,650
2042	0	0	0	0	0	0	0	0	0	0	0	0	1,650
2043	0	0	0	0	0	0	0	0	0	0	0	0	1,650
2044	0	0	0	0	0	0	0	0	0	0	0	0	1,650
2045	0	0	0	0	0	0	0	0	0	0	0	0	1,650
2046	0	0	0	0	0	0	0	0	0	0	0	0	1,650
2047	0	0	0	0	0	0	0	0	0	0	0	0	1,650
2048	0	0	0	0	0	0	0	0	0	0	0	0	1,650
2049	0	0	0	0	0	0	0	0	0	0	0	0	1,650
2050	0	0	0	0	0	0	0	0	0	0	0	0	1,650
2051	0	0	0	0	0	0	0	0	0	0	0	0	1,650
2052	0	0	0	0	0	0	0	0	0	0	0	0	1,650
2053	0	0	0	0	0	0	0	0	0	0	0	0	1,650
2054	0	0	0	0	0	0	0	0	0	0	0	0	1,650
2055	0	0	0	0	0	0	0	0	0	0	0	0	1,650
2056	0	0	0	0	0	0	0	0	0	0	0	0	1,650
2057	0	0	0	0	0	0	0	0	0	0	0	0	1,650
2058	0	0	0	0	0	0	0	0	0	0	0	0	1,650
2059	0	0	0	0	0	0	0	0	0	0	0	0	1,650
2060	0	0	0	0	0	0	0	0	0	0	0	0	1,650
2061	0	0	0	0	0	0	0	0	0	0	0	0	1,650
2062	0	0	0	0	0	0	0	0	0	0	0	0	1,650
2063	0	0	0	0	0	0	0	0	0	0	0	0	1,650
2064	0	0	0	0	0	0	0	0	0	0	0	0	1,650
2065	0	0	0	0	0	0	0	0	0	0	0	0	1,650
2066	0	0	0	0	0	0	0	0	0	0	0	0	1,650
2067	0	0	0	0	0	0	0	0	0	0	0	0	1,650
2068	0	0	0	0	0	0	0	0	0	0	0	0	1,650
2069	0	0	0	0	0	0	0	0	0	0	0	0	1,650
2070	0	0	0	0	0	0	0	0	0	0	0	0	1,650
2071	0	0	0	0	0	0	0	0	0	0	0	0	1,650
2072	0	0	0	0	0	0	0	0	0	0	0	0	1,650
2073	0	0	0	0	0	0	0	0	0	0	0	0	1,650
2074	0	0	0	0	0	0	0	0	0	0	0	0	1,650
2075	0	0	0	0	0	0	0	0	0	0	0	0	1,650
2076	0	0	0	0	0	0	0	0	0	0	0	0	1,650
2077	0	0	0	0	0	0	0	0	0	0	0	0	1,650
2078	0	0	0	0	0	0	0	0	0	0	0	0	1,650
2079	0	0	0	0	0	0	0	0	0	0	0	0	1,650
2080	0	0	0	0	0	0	0	0	0	0	0	0	1,650
2081	0	0	0	0	0	0	0	0	0	0	0	0	1,650
2082	0	0	0	0	0	0	0	0	0	0	0	0	1,650
2083	0	0	0	0	0	0	0	0	0	0	0	0	1,650
2084	0	0	0	0	0	0	0	0	0	0	0	0	1,650
2085	0	0	0	0	0	0	0	0	0	0	0	0	1,650
2086	0	0	0	0	0	0	0	0	0	0	0	0	1,650
2087	0	0	0	0	0	0	0	0	0	0	0	0	1,650
2088	0	0	0	0	0	0	0	0	0	0	0	0	1,650
2089	0	0	0	0	0	0	0	0	0	0	0	0	1,650
2090	0	0	0	0	0	0	0	0	0	0	0	0	1,650
2091	0	0	0	0	0	0	0	0	0	0	0	0	1,650
2092	0	0	0	0	0	0	0	0	0	0	0	0	1,650

Incinerator Assumptions

600,000 tonnes
500,000 tonnes

2012 Scenario - Including 165,000 Diversion To Biological Treatment

	household		commercial		Tonnage			Waste Totals	Waste Fraction	% Dry Matter Content	Total Carbon Content (Dry)	Fossil Carbon Fraction	600000 CO2 Emissions	500000 CO2 Emissions
Paper	20.87%	103,319	37.59%	275,040	30.8%	378,359	**Paper**	184800	0.308	0.900	0.354	0.000		
Glass	4.37%	21,645	1.62%	11,889	2.7%	33,533	**Glass**	16200	0.027	1.000	0.003	0.000		
Plastic	16.31%	80,729	13.41%	98,136	14.6%	178,866	**Plastic**	**87600**	**0.146**	**1.000**	**0.510**	**1.000**	163812	136339
Ferrous	1.77%	8,775	1.10%	8,059	1.4%	16,834	**Ferrous**	8400	0.014	1.000				
Aluminium	1.65%	8,190	0.62%	4,564	1.0%	12,754	**Aluminium**	6000	0.010	1.000				
Other Metals	0.47%	2,340	1.36%	9,915	1.0%	12,255	**Other Metals**	6000	0.010	1.000				
Textiles	13.00%	64,350	2.71%	19,794	6.9%	84,144	**Textiles**	**41400**	**0.069**	**0.800**	**0.500**	**0.500**	37950	31440
Organics	26.42%	130,769	31.94%	233,724	29.7%	364,493	**Organics**	178200	0.297	0.400	0.441	0.002	577	481
WEEE	0.95%	4,680	0.48%	3,534	0.7%	8,214	**WEEE**	4200	0.007	1.000				
Wood	1.06%	5,265	0.56%	4,088	0.8%	9,353	**Wood**	4800	0.008	0.850	0.500	0.000		
Others	13.12%	64,935	8.60%	62,906	10.4%	127,840	**Others**	**62400**	**0.104**	**0.800**	**0.500**	**0.500**	57200	47767
Total Fossil Fuel					21.0%	258,011								
Total Non-Fossil Fuel					79.0%	968,634								
National Totals	100%	494,997	100%	731,648	100.0%	1,226,645	**Total**	**600000**	**100.00%**	**75.52%**	**40.50%**	**23.28%**	**259539**	**216027**
Note Garden Waste 8.6%														
Dublin Totals		585000		732000		1227000								
Ratio		0.49		1.28		0.73								

Dublin Actual Waste	**household**		**commercial**
Paper	20.87%	50523	37.59% 134494
Glass	4.37%	10584	1.62% 5814
Plastic	16.31%	39477	13.41% 47988
Ferrous	1.77%	4291	1.10% 3941
Aluminium	1.65%	4005	0.62% 2232
Other Metals	0.47%	1144	1.36% 4848
Textiles	13.00%	31467	2.71% 9679
Organics	26.42%	63946	31.94% 114290
WEEE	0.95%	2289	0.48% 1728
Wood	1.06%	2575	0.56% 1999
Others	13.12%	31753	8.60% 30761
		242052	357774
		599826	

Incinerator Result Summary

Annual capacity t/y	LHV GJ/t	MCR hours h	Tonnage Thermal input MW	Net Power eff %	**NetPower output** Mwe	**District Heating** Mwe
600,000	10.5	8,000	205	29.0%	59.2	**80**
500,000	10.5	8,000	171	28.0%	47.6	**67**

	2012	
Fraction of carbon content	40.50%	IPCC 2006
Fraction of fossil carbon	23.28%	IPCC 2006
N20 Emission Factor	0.004	tonnes/GJ
CH4 Emission Factor	0.03	tonnes/GJ
Current Fuel Mix CO2	0.567	tonnes CO2 eq/MWh
CCGT CO2 Emission Factor 2020	0.44	tonnes CO2 eq/MWh
Coal CO2 Emission Factor	0.775	tonnes CO2 eq/MWh
Wind Power CO2 Emission Factor	0.03	tonnes CO2 eq/MWh
CCGT N20 Emission Factor	0.0001	tonnes/GJ
CCGT CH4 Emission Factor	0.001	tonnes/GJ

	Capacity	**CO_2 Emissions**		**N2O Emissions**		**CH4 Emissions**		**Total**	
Current	600,000	259539	tonnes	25.2	tonnes	6.3	tonnes	267483	Ton CO2Eq
	500,000	216027	tonnes	21.0	tonnes	5.3	tonnes	222647	Ton CO2Eq

GHG Savings In Electricity Production

		CO_2 Emissions							
2012 Fuel Mix	600,000	268,531	tonnes CO2 eg						
2012 Fuel Mix	500,000	216,050	tonnes CO2 eg						
District Heating	600,000	300,502	tonnes	0.6	tonnes	6.3	tonnes	300830	Ton CO2Eq
	500,000	250,544	tonnes	0.5	tonnes	5.3	tonnes	250817	Ton CO2Eq

Anaerobic Digestion

	Tonnage	Overall	
	242220	-22381.1	
Power			
	EU	180.00	kWh / tonnes of waste
	p.164	4.98	MW/242220 tonne of waste
	Total Power	24721	tonnes CO2 eq

EU Emissions	**Emission Factors**		
		CH4	
	AD Released	0.46 kg CH4 / tonne waste treated	
	AD	111.4212 tonnes	
	AD Released	2339.8 tonnes CO2 Eq	
Sequestration EU Data	**Emission Factor**		
	AD	22 kg CO2 eq / tonne	
		5328.84 tonnes	

Scenarios
Overall Results

Assumptions

Year	Incineration (tonnes)	Power (MW)	Fuel Efficiency (kg CO2 / kWh)	Renewables	Landfill Gas Recovery
2005			0.637	6.77%	
2012	600000	59.20	0.567	17.0%	75%
2013	600000	59.20	0.553	19.0%	75%
2014	600000	59.20	0.540	21.0%	75%
2015	600000	59.20	0.526	23.0%	75%
2016	600000	59.20	0.512	25.0%	75%
2017	600000	59.20	0.499	27.0%	75%
2018	600000	59.20	0.485	29.0%	75%
2019	600000	59.20	0.471	31.0%	75%
2020	600000	59.20	0.458	33.0%	75%
2021	600000	59.20	0.451	34.0%	75%
2022	600000	59.20	0.444	35.0%	75%
2023	600000	59.20	0.437	36.0%	75%
2024	600000	59.20	0.430	37.0%	75%
2025	600000	59.20	0.424	38.0%	75%
2026	600000	59.20	0.417	39.0%	75%
2027	600000	59.20	0.410	40.0%	75%
2028	600000	59.20	0.403	41.0%	75%
2029	600000	59.20	0.400	42.0%	75%
2030	600000	59.20	0.400	43.0%	75%
2031	600000	59.20	0.400	44.0%	75%
2032	600000	59.20	0.400	45.0%	75%
2033	600000	59.20	0.400	46.0%	75%
2034	600000	59.20	0.400	47.0%	75%
2035	600000	59.20	0.400	48.0%	75%
2036	600000	59.20	0.400	49.0%	75%
2037	600000	59.20	0.400	50.0%	75%
2038	600000	59.20	0.400	51.0%	75%
2039	600000	59.20	0.400	52.0%	75%
2040	600000	59.20	0.400	53.0%	75%
2041	600000	59.20	0.400	54.0%	75%

63032000

Scenario 1

75% Capture
600000 To Landfill

Biogenics 70%
Electricity - stabilises at 0.400

Electricity Unchanged after 2028

Results	Incineration CO2 (tonnes)	Power CO2 (tonnes)	Waste To Energy	Landfill CO2 eq (tonnes)	Power CO2 (tonnes)	Landfill With Energy Recovery
2012	267483	-268531	-1048.2	180567	13200	167367
2013	267483	-262061	5422.4	180567	13200	167367
2014	267483	-255590	11893.1	180567	13200	167367
2015	267483	-249119	18363.7	180567	13200	167367
2016	267483	-242649	24834.3	180567	13200	167367
2017	267483	-236178	31305.0	180567	13200	167367
2018	267483	-229707	37775.6	180567	13200	167367
2019	267483	-223237	44246.2	180567	13200	167367
2020	267483	-216766	50716.9	180567	13200	167367
2021	267483	-213531	53952.2	180567	13200	167367
2022	267483	-210296	57187.5	180567	13200	167367
2023	267483	-207060	60422.8	180567	13200	167367
2024	267483	-203825	63658.1	180567	13200	167367
2025	267483	-200590	66893.4	180567	13200	167367
2026	267483	-197354	70128.8	180567	13200	167367
2027	267483	-194119	73364.1	180567	13200	167367
2028	267483	-190884	76599.4	180567	13200	167367
2029	267483	-190884	76599.4	180567	13200	167367
2030	267483	-190884	76599.4	180567	13200	167367
2031	267483	-190884	76599.4	180567	13200	167367
2032	267483	-190884	76599.4	180567	13200	167367
2033	267483	-190884	76599.4	180567	13200	167367
2034	267483	-190884	76599.4	180567	13200	167367
2035	267483	-190884	76599.4	180567	13200	167367
2036	267483	-190884	76599.4	180567	13200	167367
2037	267483	-190884	76599.4	180567	13200	167367
2038	267483	-190884	76599.4	180567	13200	167367
2039	267483	-190884	76599.4	180567	13200	167367
2040	267483	-190884	76599.4	180567	13200	167367
2041	267483	-190884	76599.4	180567	13200	167367
Sum			1741507			5021000

	2012	2041	Overall
Incineration	-1,048	76,599	1,741,507
Landfilling	167,367	167,367	5,021,000
Balance	-168,415	-90,767	-3,279,493
% of Kyoto Target	-0.27%	-0.14%	-0.17%

Scenario 2

75% Capture
500000 To Landfill

Results	Incineration CO2 (tonnes)	Power CO2 (tonnes)	Waste To Energy	Landfill CO2 eq (tonnes)	Power CO2 (tonnes)	Landfill With Energy Recovery
2012	222647	-216050	6597.7	153500	11000	142500
2013	222647	-210844	11803.8	153500	11000	142500

	2012	2041	Overall
Incineration	6,598	69,070	1,624,381

	2014	222647	-205638	17009.8	153500	11000	142500
	2015	222647	-200432	22215.8	153500	11000	142500
	2016	222647	-195226	27421.8	153500	11000	142500
	2017	222647	-190020	32627.8	153500	11000	142500
	2018	222647	-184814	37833.8	153500	11000	142500
	2019	222647	-179608	43039.9	153500	11000	142500
	2020	222647	-174402	48245.9	153500	11000	142500
	2021	222647	-171799	50848.9	153500	11000	142500
	2022	222647	-169196	53451.9	153500	11000	142500
	2023	222647	-166593	56054.9	153500	11000	142500
	2024	222647	-163990	58657.9	153500	11000	142500
	2025	222647	-161387	61260.9	153500	11000	142500
	2026	222647	-158783	63863.9	153500	11000	142500
	2027	222647	-156180	66466.9	153500	11000	142500
Electricity Unchanged after 2028	**2028**	222647	-153577	69069.9	153500	11000	142500
	2029	222647	-153577	69069.9	153500	11000	142500
	2030	222647	-153577	69069.9	153500	11000	142500
	2031	222647	-153577	69069.9	153500	11000	142500
	2032	222647	-153577	69069.9	153500	11000	142500
	2033	222647	-153577	69069.9	153500	11000	142500
	2034	222647	-153577	69069.9	153500	11000	142500
	2035	222647	-153577	69069.9	153500	11000	142500
	2036	222647	-153577	69069.9	153500	11000	142500
	2037	222647	-153577	69069.9	153500	11000	142500
	2038	222647	-153577	69069.9	153500	11000	142500
	2039	222647	-153577	69069.9	153500	11000	142500
	2040	222647	-153577	69069.9	153500	11000	142500
	2041	222647	-153577	69069.9	153500	11000	142500
	Sum			1624381			4275000

Landfilling	142,500	142,500	4,275,000
Balance	-135,902	-73,430	-2,650,619
% of Kyoto Target[1]	-0.22%	-0.12%	-0.14%

Scenario 3

	Results	Incineration CO2 (tonnes)	Power CO2 (tonnes)	Waste To Energy	Landfill CO2 eq (tonnes)	Power CO2 (tonnes)	AD& power	otal Landfilling/AD
75% Capture	2012	267483	-268531	-1048.2	60467	7871	-22381	30214
357780 To Landfill	2013	267483	-262061	5422.4	60467	7871	-22381	30214
	2014	267483	-255590	11893.1	60467	7871	-22381	30214
	2015	267483	-249119	18363.7	60467	7871	-22381	30214
	2016	267483	-242649	24834.3	60467	7871	-22381	30214
	2017	267483	-236178	31305.0	60467	7871	-22381	30214
	2018	267483	-229707	37775.6	60467	7871	-22381	30214
	2019	267483	-223237	44246.2	60467	7871	-22381	30214
	2020	267483	-216766	50716.9	60467	7871	-22381	30214
	2021	267483	-213531	53952.2	60467	7871	-22381	30214
	2022	267483	-210296	57187.5	60467	7871	-22381	30214
	2023	267483	-207060	60422.8	60467	7871	-22381	30214
	2024	267483	-203825	63658.1	60467	7871	-22381	30214
	2025	267483	-200590	66893.4	60467	7871	-22381	30214
	2026	267483	-197354	70128.8	60467	7871	-22381	30214
	2027	267483	-194119	73364.1	60467	7871	-22381	30214
Electricity Unchanged after 2028	**2028**	267483	-190884	76599.4	60467	7871	-22381	30214
	2029	267483	-190884	76599.4	60467	7871	-22381	30214
	2030	267483	-190884	76599.4	60467	7871	-22381	30214
	2031	267483	-190884	76599.4	60467	7871	-22381	30214
	2032	267483	-190884	76599.4	60467	7871	-22381	30214
	2033	267483	-190884	76599.4	60467	7871	-22381	30214
	2034	267483	-190884	76599.4	60467	7871	-22381	30214
	2035	267483	-190884	76599.4	60467	7871	-22381	30214
	2036	267483	-190884	76599.4	60467	7871	-22381	30214
	2037	267483	-190884	76599.4	60467	7871	-22381	30214
	2038	267483	-190884	76599.4	60467	7871	-22381	30214
	2039	267483	-190884	76599.4	60467	7871	-22381	30214
	2040	267483	-190884	76599.4	60467	7871	-22381	30214
	2041	267483	-190884	76599.4	60467	7871	-22381	30214
	Sum			1741507				906431

	2012	2041	Overall
Incineration	-1,048	76,599	1,741,507
Landfilling	30,214	30,214	906,431
Balance	-31,263	46,385	835,076
% of Kyoto Target[1]	-0.05%	0.07%	0.04%

Scenario 4

	Results	Incineration CO2 (tonnes)	Power CO2 (tonnes)	Waste To Energy	Landfill CO2 eq (tonnes)	Power CO2 (tonnes)	AD& power	otal Landfilling/AD
50% Capture	2012	267483	-268531	-1048.2	120933	7871	-22381	90681
357780 To Landfill	2013	267483	-262061	5422.4	120933	7871	-22381	90681
	2014	267483	-255590	11893.1	120933	7871	-22381	90681
	2015	267483	-249119	18363.7	120933	7871	-22381	90681
	2016	267483	-242649	24834.3	120933	7871	-22381	90681
	2017	267483	-236178	31305.0	120933	7871	-22381	90681
	2018	267483	-229707	37775.6	120933	7871	-22381	90681
	2019	267483	-223237	44246.2	120933	7871	-22381	90681
	2020	267483	-216766	50716.9	120933	7871	-22381	90681
	2021	267483	-213531	53952.2	120933	7871	-22381	90681
	2022	267483	-210296	57187.5	120933	7871	-22381	90681

	2012	2041	Overall
Incineration	-1,048	76,599	1,741,507
Landfilling	90,681	90,681	2,720,431
Balance	-91,729	-14,082	-978,924
% of Kyoto Target[1]	-0.15%	-0.02%	-0.05%

	2023	267483	-207060	60422.8	120933	7871	-22381	90681
	2024	267483	-203825	63658.1	120933	7871	-22381	90681
	2025	267483	-200590	66893.4	120933	7871	-22381	90681
	2026	267483	-197354	70128.8	120933	7871	-22381	90681
	2027	267483	-194119	73364.1	120933	7871	-22381	90681
Electricity Unchanged after 2028	**2028**	267483	-190884	76599.4	120933	7871	-22381	90681
	2029	267483	-190884	76599.4	120933	7871	-22381	90681
	2030	267483	-190884	76599.4	120933	7871	-22381	90681
	2031	267483	-190884	76599.4	120933	7871	-22381	90681
	2032	267483	-190884	76599.4	120933	7871	-22381	90681
	2033	267483	-190884	76599.4	120933	7871	-22381	90681
	2034	267483	-190884	76599.4	120933	7871	-22381	90681
	2035	267483	-190884	76599.4	120933	7871	-22381	90681
	2036	267483	-190884	76599.4	120933	7871	-22381	90681
	2037	267483	-190884	76599.4	120933	7871	-22381	90681
	2038	267483	-190884	76599.4	120933	7871	-22381	90681
	2039	267483	-190884	76599.4	120933	7871	-22381	90681
	2040	267483	-190884	76599.4	120933	7871	-22381	90681
	2041	267483	-190884	76599.4	120933	7871	-22381	90681
	Sum			1741507				2720431

Scenario 5	Results	Incineration CO2 (tonnes)	Power CO2 (tonnes)	Waste To Energy	Landfill CO2 eq (tonnes)	Power CO2 (tonnes)	AD& power	otal Landfilling/AD
50% Capture	2012	267483	#REF!	#REF!	120933	7871	-22381	90681
357780 To Landfill	2013	267483	#REF!	#REF!	120933	7871	-22381	90681
	2014	267483	#REF!	#REF!	120933	7871	-22381	90681
	2015	267483	#REF!	#REF!	120933	7871	-22381	90681
District Heating	2016	267483	#REF!	#REF!	120933	7871	-22381	90681
	2017	267483	#REF!	#REF!	120933	7871	-22381	90681
	2018	267483	#REF!	#REF!	120933	7871	-22381	90681
	2019	267483	#REF!	#REF!	120933	7871	-22381	90681
	2020	267483	#REF!	#REF!	120933	7871	-22381	90681
	2021	267483	#REF!	#REF!	120933	7871	-22381	90681
	2022	267483	#REF!	#REF!	120933	7871	-22381	90681
	2023	267483	#REF!	#REF!	120933	7871	-22381	90681
	2024	267483	#REF!	#REF!	120933	7871	-22381	90681
	2025	267483	#REF!	#REF!	120933	7871	-22381	90681
	2026	267483	#REF!	#REF!	120933	7871	-22381	90681
	2027	267483	#REF!	#REF!	120933	7871	-22381	90681
Electricity Unchanged after 2028	**2028**	267483	#REF!	#REF!	120933	7871	-22381	90681
	2029	267483	#REF!	#REF!	120933	7871	-22381	90681
	2030	267483	#REF!	#REF!	120933	7871	-22381	90681
	2031	267483	#REF!	#REF!	120933	7871	-22381	90681
	2032	267483	#REF!	#REF!	120933	7871	-22381	90681
	2033	267483	#REF!	#REF!	120933	7871	-22381	90681
	2034	267483	#REF!	#REF!	120933	7871	-22381	90681
	2035	267483	#REF!	#REF!	120933	7871	-22381	90681
	2036	267483	#REF!	#REF!	120933	7871	-22381	90681
	2037	267483	#REF!	#REF!	120933	7871	-22381	90681
	2038	267483	#REF!	#REF!	120933	7871	-22381	90681
	2039	267483	#REF!	#REF!	120933	7871	-22381	90681
	2040	267483	#REF!	#REF!	120933	7871	-22381	90681
	2041	267483	#REF!	#REF!	120933	7871	-22381	90681
	Sum			#REF!				2720431

	2012	2041	Overall
Incineration	#REF!	#REF!	#REF!
Landfilling	90,681	90,681	2,720,431
Balance	#REF!	#REF!	#REF!
% of Kyoto Target[1]	#REF!	#REF!	#REF!

Landfill Results

Overall Results - IPCC Waste Model

Landfill Methane Generation (CO_2 Equivalent)

	Tonnage			
	600,000	500,000	357,780	
75% Recovery	5417	4605	1814	Gg
50% Recovery	10834	9211	3628	Gg

Greenhouse Gas Emissions

Capacity	CH4 Emissions		
600,000	5.42E+06	Tonnes CO2 Equiv	75% Landfill Gas Capture
500,000	4.61E+06	Tonnes CO2 Equiv	75% Landfill Gas Capture
357,780	1.81E+06	Tonnes CO2 Equiv	75% Landfill Gas Capture
Capacity	**CH4 Emissions**		
600,000	1.08E+07	Tonnes CO2 Equiv	50% Landfill Gas Capture
500,000	9.21E+06	Tonnes CO2 Equiv	50% Landfill Gas Capture
357,780	3.63E+06	Tonnes CO2 Equiv	50% Landfill Gas Capture

GHG Savings

Capacity	CO_2 Emissions		Total 30 Years	
600,000	13,200	tonnes	3.96E+05	Tonnes CO2 Equiv
500,000	11,000	tonnes	3.30E+05	Tonnes CO2 Equiv
357,780	7,871	tonnes	2.36E+05	Tonnes CO2 Equiv

Landfill Methane Sequestered (CO_2 Equivalent)

IPCC	Tonnage			
	600,000	500,000	357,780	
	6427	5463	2167	Gg

Capacity	C Sequestration		
600,000	6.43E+06	Tonnes CO2 Equiv	
500,000	5.46E+06	Tonnes CO2 Equiv	
357,780	2.17E+06	Tonnes CO2 Equiv	

Energy Saving (Raw MSW)	0.022	tonnes CO2 Eq / tonne MSW	**Reference: EU Waste Management Options & Climate Change (2001)**

Overall GHG Emissions	Total Over 30 Years		
600,000	5.02E+06	Tonnes CO2 Eq	**No sequestration**
500,000	4.28E+06	Tonnes CO2 Eq	
357,780	1.58E+06	Tonnes CO2 Eq