Transition Cornwall Network

Objections to the incinerator proposal for Rostowrack Farm

Application: `08/00203/WAS

From
Transition Cornwall Network

February 2009

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Contents

Summary

1 Non compliance with waste hierarchy

WID efficiency calculation

- Using the most recent information from ERM on the proposed incinerator output and internal energy demands and the correct use for the WID formula, as explained in the Commission non-paper on the topic the Base Case is 58% efficient
- The proposal does not meet the required efficiency level to be considered Recovery
- It is therefore Disposal, at the lowest on the Waste Hierarchy and hence the Application should not be recommended for approval

2 PPS1 Planning and Climate Change Supplement:

Carbon balance

The arguments on why the greenhouse gas balance for this proposal should include the fate of all the carbon being treated by the options under discussion include :-

- The IPCC guidelines are for greenhouse gas inventories at national level and contain simplifying assumptions. They do however state that all greenhouse gas emissions from incineration with energy recovery should be reported, with the biogenic carbon emissions being reported to the Energy Sector.
- This method is also used by authorities including
  - ERM in work for Defra,
  - Eunomia and Peer Review on this work for the Greater London Authority,
  - US Environmental Protection Agency,
  - Biffaward Programme
- The atmosphere responds exactly the same way to CO_2 of fossil origin as to biogenic CO_2.
- When materials are burnt their carbon, of whatever origin, goes straight to atmosphere as CO_2, whereas when materials are buried in a managed landfill a proportion is captured and stays in the ground for a long time, reducing the CO_2 output. Ignoring this fact produces a false picture of greenhouse gas impacts.
- Cornwall County Council has undertaken through the Nottingham Declaration and in other ways to reduce its greenhouse gas emissions. To do this, the Council needs clear accurate information on any options proposed, and then follow polices which reduce greenhouse gas emissions.

In the interests of providing useful and accurate information to the Council it was decided to provide the carbon balances for three options for the treatment of the 240,000 tpa of “black bag” waste arisings.
These options are:-

Option		Main materials effect
1	Incinerator (present application)	Destruction
2	Landfill “Do Nothing”	Disposal
3	Materials Recovery	Recovery

The Materials Recovery Option is assessed as the EU Directive 2008/98 EC on waste requires Member States to instigate separate collection and treatment of food waste within two years, ie by 2010. As this will therefore be required , regardless of any decision on the proposed incinerator, the high materials recovery route was investigated.

This route assumes separate collection of food waste and its treatment in dedicated anaerobic digestion plant, followed by composting allied to treatment in five small locations of the remaining waste (208,000 tpa), via autoclaves to sterilise material followed by material separation and AD treatment of the organic matter, and then composting of residues. This method allows high reclaiming of materials for re-use and some energy to offset the plant emissions along with soil improvements.

The impact on actual greenhouse gas emissions of each treatment option is summarised in the table below.

Emissions for each option tpa CO_2e (avoided as -)

Emissions activity	**1 Incinerator**	**2 Landfill**	**3 Materials recovery**
Transport	6,671	6,671	3,000
Processing operations	194,883	45,836	76,920
Processing avoided	- 69,023	- 7,862	- 24,606
Disposal/final use avoided	- 11,861	- 69,149	- 37,471
Total balance	**120,670**	**- 24,504**	**17,843**

This table shows that the landfill option is the only one with a net greenhouse gas balance which is positive, largely because of the carbon which is left in the ground trapped in plastics and other materials. The incinerator, on the other hand, by taking the energy out of all of the carbon containing materials, releases that carbon into the atmosphere as CO_2 and hence provides an immediate and long lasting boost to local greenhouse gas emissions totalling some 120,000 tpa.

The Incinerator (Option 1) releases 3 million tonnes CO_2 e over 25 years from its operations, and compared to the landfill option releases an extra 3.6 million tonnes CO_2 e over the same period.

Both of the other options (2 and 3) provide much lower impact on greenhouse gas emissions with the Materials Recovery option which also provides significant value in terms of recycled materials for use and some local energy value.

PPS1 *Planning and Climate Change Supplement* states that climate change is a material consideration. Planning authorities are required to prepare spatial strategies which "*secure the highest viable resource and energy efficiency and reduction in emissions"*;

From the above analysis it is clear that the proposed incinerator does not meet this requirement, and the Application should therefore be refused.

3 Non-compliance with National Waste Strategy and Need Assessment

In the ERM report of October 2008 it is clear that ERM is only making an assertion in its statement that the recycling targets will be met, with an incinerator in place in Cornwall, and hence the National Waste Strategy will be complied with.

This assertion has no facts or plans to back it. The *Task 1 Need Assessment report* seeks to make a case that the recycling targets will be met purely through reference to a number of scenarios, at various levels of recycling up to national targets.

There are no plans proposed for how Sita as the MSW contract holder and Applicant for the incinerator intends to meet the recycling targets and no suggestion that they will be putting in place any system or process to achieve this.

Another major omission in this Need Assessment is any awareness of the changing policy background in waste issues in Europe, nationally, regionally and locally. For example the new EU Directive 2008/98 EC requires Member States to legislate for separate collection and treatment of food waste within two years of the Directive ie by 2010.

This is a level of attention to vital elements of the Application, and as such could not be regarded as a full Application. The Application should be refused on the grounds that:

- It is unclear either that the required recycling & composting targets will be met or that anything other than some scenario building has been undertaken to ensure that they are met by the County waste contractor.
- No account has been taken of the changing policy framework and trend to increased recycling targets

- The recession is likely to minimise waste well below any possible assessment of need as outlined in this Application, probably to around 55% of the proposed capacity, with a minimal 1.5% reduction in waste arisings, present day levels of recycling over four years and following the EU Directive on separate collection & treatment of food waste .

4 BPEO and Waste Local Plan are flawed

ERM incorrectly discount the TCN assessment of the AEA Technology BPEO which lead to the Waste Local Plan as being their own report. They could not find the figures quote as they were in another report.

The TCN criticisms of the Waste Local Plan therefore still stand. The original BPEO was flawed and hence the Waste Local Plan based in it is also flawed.

In addition the Plan has been largely overtaken by policy changes at higher levels, European, national and regional, all of which require higher recycling and composting levels and more decentralised community based approaches.

5 WRATE reports

Although the fact that ERM were involved in the development of WRATE is held to be a self evident proof of its expertise in this tool, this is not necessarily the case, as staff can change and expertise lost. The lack of transparency and external peer review indicates that this is not the case, given the facility within the program to ensure peer review of results.

In particular this tool has been found wanting by a Planning Inspector because of its subjective nature, when dismissing an Appeal for an incinerator by Sita in Kent .

1 Waste recovery vs. waste disposal

ERM response
TCN presents a calculation that, it claims, demonstrates that CERC does not meet the new Waste Incineration Directive (WID) formula for waste recovery, and therefore must be classed as a disposal operation.
However, TCN's calculation is wrong on a number of counts, most critically in that it uses net electricity exported instead of total electricity generated, and does not take account of energy from fuel and imported electricity. The CERC meets Waste Strategy 2007's definition of recovery, and Sita's engineers have designed the plant so that it will also meet the WID definition of recovery.

Exporting heat to Goonvean but not Imerys, CERC is estimated (using a throughput of 240ktpa waste with a CV of 9.8MJ/kg) to have a WID efficiency of 65.9%. If Imerys is also included, that increases to 67.1%.

Response to ERM from TCN
These notes from ERM are assertions. There is no sign of the calculation or even notes on the way to carry out the calculation in question. TCN refers to the method set out by the European Commission, and then uses this method to work through the calculation, with the workings open for scrutiny

1.1 Definition of energy efficiency under EU rules for WID

Energy efficiency calculations always include an element for the efficiency of the process, the energy lost in generating the useful energy is a vital part of the calculation. Without this, energy efficiency calculations would always yield an efficiency of 100%!

The EU literature on efficiency calculations for recovery vs. disposal are clearly stated as noted below:

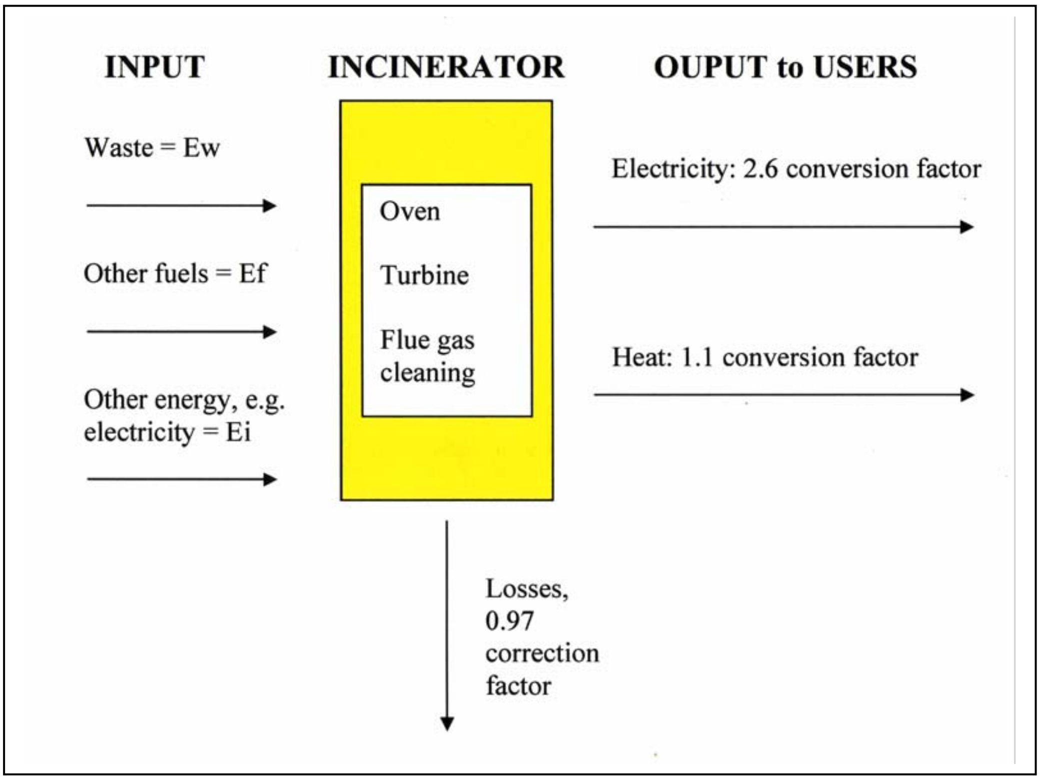
- **Non-paper on the background of the development of the Commission proposal on the distinction between energy recovery and disposal of waste in municipal incinerators**

The Commission has prepared this non-paper to give additional background on its proposal.

Quotes from this

In summary, the formula calculates the energy output divided by the energy input. It corrects the result
(1) to avoid counting energy produced from other fuels than waste,
(2) for normal energy losses, and
(3) for the purpose of comparing the electricity and heat delivered to users. The energy flows taken into consideration can be represented as follows:

Diagram from non paper



8. Therefore, the Commission has proposed that incinerators with an energy efficiency factor equal or above 0.6 would be classified as recovery installations. To take into account technological progress and to foster innovation the Commission also proposed that this threshold would be raised in 2009 to 0.65.

Footnote

3 Use of electricity for the flue gas cleaning system is considered as being made available to users – otherwise the threshold would have an inhibiting effect on strengthening the air polluting standards beyond the levels set by the Waste Incineration Directive.

These notes and the diagram make it clear that the energy efficiency calculation must include the energy used to generate the useful energy, with the only parasitic loss included on the output side being the energy required to control air pollution. It clearly stets on the output side "Output to users" and the footnote states to include air pollution control energy needs.. This makes clear that internal uses other than air pollution control energy are not included as "output energy"

- This is further backed up by the European Commission document on Best Available Techniques for Incineration which was produced under Directive 96/61/EC (IPPC Directive)

European Commission Integrated Pollution Prevention and Control
Reference Document on the Best Available Techniques for Waste Incineration
August 2006
Quote: p 590-591
The main energy flows in waste incinerators can be summarised as:
a) Energy inputs (imported)

- only the energy input that is imported for the incineration process itself is included (see also d below). This will include, for example, the energy required for operation of a bulky waste shredder
- energy required to operate, for example, a full RDF plant (whether on site or not) is (for the purposes of this calculation) outside the system boundary and should not be included in the calculation (however it should be noted that this may be very significant if a wider life cycle boundary calculation is attempted)
- do not include energy required for waste collection, transportation and external pre-treatment that is not necessary for the incineration process
- other energy imported to the site is included as an input e.g. electricity, natural gas for flue gas reheating and/or oil for auxiliary burners, as long as they are partly or totally used to cover the energy needed in the incineration process.

b) Energy conversion

This is the energy from wastes/fuels that is converted in the incinerator to another form (e.g. steam or syngas) for export or circulation.

c) Energy outputs (exported)

- only the actual amount of energy exported is included (i.e. the gross production minus the energy circulated and consumed as losses to run the process itself)
- auxiliary on-site energy usage such as lighting and heating for offices should only be taken into account in the efficiency calculation if these figures are available and if a very precise balance is wanted. Otherwise this influence is considered small and can be neglected
- where energy is used on-site for another process (e.g. drying of sewage sludge or for running a district heating) this is counted as an output (export).

d) Circulated energy as energy losses (for explanation see figure above)

This is the energy that is generated by the process (e.g. steam/heat/electricity) that is then used in the process itself. This energy is not considered to count as a system input because it has not been imported from outside the system boundary. However, it is considered important that such circulation (if it is providing for energy losses) should be identified (as they substitute for imported energy) and should therefore be included in the check-list.

The calculation from BREF is therefore as follows::

Efficiency =(energy exported)/ (energy in waste+ energy imported + energy circulated)X100%

This is the EC view on the issue.

The calculation is therefore reworked below to show the efficiency results.

1.2 Calculation of energy efficiency under EC rules

1.2.1 Internal energy use in process

EA Environmental Permit application documentation from Sita

It has been possible by detailed inspection of the EA Environmental permit application submitted by Sita to determine the in-house use of energy and its breakdown, which is not provided in the planning application documents

Table 10.3 Breakdown of Annual Delivered Energy Consumption by Activity Area

Activity	**MWh pa electricity**	**MWh pa oil**
Waste bunker	1,709	
Boiler/furnace	5,492	2,950
FGT	6,261	
Steam cycle	3,561	
Auxiliaries	2,928	
Condensing	3,790	
Bottom ash	641	
Administration	1,068	
Total	**25,450**	

This shows that the Flue Gas Treatment plant (FGT) requires only some 6,261 MWh out of the total electricity requirements of 25,450 MWh or some 25% of internal electricity uses. This figure is therefore used in the calculation of energy efficiency under WID which follows.

1.2.2 Analysis of incinerator efficiency for WID efficiency purposes

Production of electricity				
From ERM	Exported electricity		16.6	MW
	Electricity production		152,430	MWh pa
	Electricity export		129,280*	MWh pa
Waste input	tpa		**240,000**	
waste CV	from ERM response docs		9.8	at MJ/kg
input waste energy			653,333	MWh
Electrical efficiency			19.8%	
Heat sales to Goonvean approx			2.35	MW
		from ERM carbon report	18,800	MWh pa
	Gives heat efficiency		2.88%	
Total thermal efficiency			22.67%	
WID formula for "efficiency"				
	energy produced-energy from fuels used-other energy imports			
	X 0.97 (waste energy input + energy from fuels)			
	times	2.6	for electricity produced	
		1.1	for heat produced	
Energy input				
	waste		**653,333**	MWh pa
	energy imports	electricity	650	MWh pa
		oil	2,950	MWh pa
		total imports	**3,600**	MWh pa
	total energy input		**656,933**	MWh pa
Energy output				
	useful energy	electricity	129,280	MWh pa
		heat	18,800	MWh pa
	plus Air pollution control energy			
	internal electricity used		25,450	MWh pa
	air pollution control uses from EA appln.		6,261	MWh pa
	total "useful energy output"		**154,341**	MWh pa
Electricity counts as			2.6	
	electricity number to use		352,407	MWh pa
Heat counts as			1.1	
	heat number to use		20,680	MWh pa
Total "useful" energy after application of WID factors			**373,087**	MWh pa
Calculation top line				
energy produced-energy from energy imports			369,487	MWh pa
Calculation bottom line				
(waste energy input + energy from fuels)			656,933	
		times 0.97	637,225	
Result Base Case	WID efficiency		**58%**	

**this figure is the highest electricity output figure found in the documents from ERM*

The efficiency figure for this proposed incinerator is therefore 58%.

It is completely unclear how the consultants reached a figure of 65.9% from this calculation using the information presented in their various reports and responses.

This open calculation is easy to check and verify, unlike the opaque results presented by the Applicant's consultants, where it not possible to   check either methodology or numbers used by the Applicant or their consultants. TCN is happy to supply the spreadsheet used for these calculations so that they can be further checked and verified.

1.2.3 conclusion of energy efficiency calculation

The result from this calculation is that the incinerator remains as disposal, by a considerable margin rather than recovery and therefore cannot meet the Council's policy of moving up the waste hierarchy. The limit required under the Directive being 65%, and the Base Case incinerator reaching 58%.

The incinerator should therefore be refused planning permission

The EU Directive 2008/98EC requires a permit to be given to an incinerator before it can operate and one of the permitting requirements is that the incinerator should reach a high level of energy efficiency. As this proposed incinerator fails this test it would not be permittable under the new Waste Directive.

2 Carbon balance for waste treatment options

The carbon balance depends on the three activities of construction, transport and operation. The main emissions are from the operation of the plant tis section assesses the carbon balance for each of three options as noted below and reaches conclusions based on an assessment of actual carbon emissions.

Notes from Applicants response December 2008

Table 1.14. It is noted that the "do nothing" scenario would require waste to be transported out of the County for disposal after 2012 however the reasons for this assumption are unclear. Please explain the reasons for this statement and also whether there may be other waste management options available other than to transport waste out of the County under this scenario	The do nothing scenario involves landfilling waste, and the Need Assessment estimated that landfill capacity in the county would be exhausted by 2012

It is noted that there are several viable and quicker options for non-incineration treatment of residual waste which would yield lower greenhouse gas emissions and which could be implemented in Cornwall within a reasonable timeframe. To follow up this comment from CCC a high materials recovery option is proposed to counter the proposed "materials destruction" and the other option of "materials disposal". Then notes following indicate the greenhouse gas balance for a high materials recovery option

2.1 Example alternative materials recovery option

The EU Directive on wastes 2008/96 EC requires all Member States to instigate separate food waste collection and proper treatment by 2010, so a reasonable alternative scenario to the incinerator would be a system incorporating this requirement. This requirement will any case be legally required in a much earlier timeframe than any incinerator. As a general rule Member States have two years from the issuing of any Directive to pass appropriate legislation to implement the Directive.

Example system for high materials recovery
:separate food waste collection into Anaerobic Digestion
with MBT/autoclave and AD for residual "black bag" residual wastes

For ease of understanding the calculations for this greenhouse gas balance the tables below are an outline of the steps involved in the calculation, with the sources of information given where ever possible.

2.1.1 Food wastes segregated collection and treatment

1 Transport emissions for separate food waste collection

Food wastes separate collection to 2 AD sites		
assume as per all WCAs -10% to allow to 2 sites not one		
mpa	445,920	
kmpa	717,485	
fuel use	0.71	l/km
total fuel use	509,414	L pa
CO_2 coefficient	2.63	kg CO_2/l diesel
CO_2 emissions	**1,340**	**tpa CO_2**

2 Segregated food waste via AD/compost :main parameters

Parameter	Number	Unit	Source
Food waste arisings	21.40%		ERM carbon balance mar 2008
tonnage arising	51,360	tpa arisings	Total C - 12.5% or so fresh matter (125 kg per tonne)
Carbon present	6,420	12.5% carbon in food waste	Options for Dealing with Food Waste
Capture rate	62%		WRAP Evaluation of separate food waste collection systems 2008
Food waste	**31,843**	**tpa**	
Dry matter content	9,553	tpa	
Gas production	140	m3/tonne food waste c 60% methane energy value of 831 kWh	Greenfinch Digester experience from website 165 av with AEA Technology 2001 EC report 114 includes pasteurising unit to ensue ABP Regs met
Energy in gas	26,462	MWh pa	
Electricity produced	9,526	MWh at 36% eff.	
Useful heat produced	13,231	MWh at 50% eff.	
Internal heat use	4,631	35%	
Internal elec use	1,429	15%	
Heat available for sale	8,600	MWh pa	
Electricity for sale	8,097	MWh pa	

3 GHG balance for segregated food waste AD plant

assume two locations

Useful energy output	**MWh pa**	**CO_2 avoided tpa**	
Electricity	8,097	3,482	
Heat	6,450	1,387	75% of heat sold to local demands replaces oil/gas 50/50
Total	**14,547**	**4,869**	
Biogas produced	3,465	tpa at 60% methane	

4 GHG balance for segregated. food waste compost maturation in open windrows

Parameter		Value	Source
from AD plant after dewatering		13,529 tpa	AEA Technology
CO_2 losses		46%	Schliess ökologischer Sicht: Situationsanalyse, Szenarioanalyse, ökonomische und ökologische Bewertung sowie Synthesis 1999
Carbon input		2,043	
Carbon loss as CO_2		3,446tpa	
N_2O	From N input in feedstock	1%	Eunomia 2007 Applying Life-cycle Thinking in the Framework of Cost-benefit Analysis
N in food wastes		2.20%	*www.suewaste.soton.ac.uk*
N_2O output		2.98	tpa N2O at 310 GWP
CO_2 e		1,450	tpa CO2e
methane		trace only	Eunomia 2007
energy use in windrows CO2		36 tpa	Eunomia CBA report on biowaste 07
N2O		1,450	tpa CO2e
CO2		3,446	tpa CO2
total		4,932	tpa CO2e
Transport to use sites		estimate	
travel	447,659	km	Assume 45km to use sites plus 10km for liquids to agriculture
total CO2 at RTS rates, as earlier calcs		100	Tpa CO2
Total emissions		**5,072**	**Tpa CO2e**
Avoided emissions		**3,601**	**Replacement of peat : AEA Technology**
Net emissions		**1,471**	**Tpa CO2e**

5 Summary of GHG balance for separate food waste collection and processing AD followed by composting tpa CO2e

Activity	Emissions	Avoided emissions	Net emissions
Segregated collection	1,340		1,340
AD plant including shredding. pasteurisation etc		4,869	-4,869
Composting & transport to users, peat replacement	5,072	3,601	1,471
Compost in use 8.2% C sequestration		626	-626
Total	**6,412**	**9,096**	**-2,684**

The net GHG emissions for the food waste fraction is therefore minus 2,680 tpa CO2e.

2.1.2 Residual black bag wastes

The Treatment modelled here, for the remaining 208,000 tpa of "black bag" MSW is passing through an autoclave with high temperature steam in a rotating kiln, followed by separation of the main fractions into organic matter (as pulp) and clean metals, glass and plastics which are sorted by various separation technologies. This method gives clean recyclates and separates out some 85% of the organic fraction for further processing.

The Organic fraction is then subject to Anaerobic Digestion followed by compost maturation, and the clean recyclates are sent for re-use

1 Transport emissions

Laden t km pa for residual black bag to five locations for treatment *

laden only journeys		**mpa**	**kmpa**	**T kmpa**
WCAs		495,466	797,205	5,858,747
HWRCs		91,840	147,770	765,450
RTSs	plant at 5 locations		-	
MRFs				5,085
Disposal routes	Assumes higher recyclate capture of +30%			229,333
Totals		587,306	944,976	6,858,615

** assumed close to present RTS locations for ease of calculation and comparison*

This options saves some 5,553,600 t km pa in transport emissions and costs compared to the proposed incinerator

Transport emissions from residuals collection including return journeys

Route	**kmpa**	**mpg**	**l/km**	**Fuel lpa burnt ***
WCAs	797,205	4.00	0.71	566,016
HWRCs	147,770	6.98	0.40	59,108
RTSs	-			-
MRFs	598	6.69	0.40	239
Disposal routes	14,495	6.98	0.40	5,798
totals	***960,069***			***631,161***
CO2 coefficient		2.63	kgCO2/l diesel	
CO2 emissions		**1,660**	**tCO2pa**	

**Assumes laden fuel use time 1.6 to allow for return journey*

2 GHG balance for residuals into autoclave

Parameter	Number	Unit	Co-efficient	Unit	Source
MRF activities					Hyder Consulting for Milton Keynes Council "Carbon Assessment" September 2008
Electricity use	10,408	MWh pa	50	kWh/t waste	
Diesel use	116,568	l diesel	0.56	Litres/tonne	
Autoclave					
Electricity use	12,177		45	kWh/t input x1.3 for small plant	Eunomia, Greenhouse Gas Balances of Waste Management Scenarios, Jan 2008
Heat demand	30,849		114		
	total energy used	**CO2tpa**			
electricity	22,585	9,712			
diesel for plant & steam raising	147,417	35,380			
Totals	**163,272**	**42,198**			

3 Organic fraction after autoclave into AD GHG balance

Parameter	Number	Unit	Source
Organic waste from autoclave	54,552	**tpa**	
Dry matter content	35,419	tpa	
Gas production	140		Greenfinch Digester experience from website 165 av with AEA Technology 2001 EC report 114 plus Westerns Isles Dry MSW AD plant at 123kWh production/t input MSW
Energy in gas	45,333	MWh pa	
Electricity produced	16,320	MWh pa	
Useful heat produced	22,666	MWh	
Elec/ Heat used by digester	15%		
GHG balance for AD after autoclave			
Carbon input			
carbon input organic fraction	15,349	tpa	
Energy used in processing	**MWh pa**	**CO2 tpa**	
electricity	2,448	Used from internally produced energy: RE sourced	
heat	3,400		
total	5,848		
	Useful energy output	**Avoided CO2 tpa**	
electricity	13,872	5,965	CO2 co-efficients
heat	19,266		430
assume heat sales 85%	16,376	3,521	replacing gas/oil 50/50 215
totals	**30,248**	**9,486**	

4 Organic residuals to compost maturation GHG balance

Parameter	Value	Unit
Input fraction	31,601	Tpa
Five plants each of approx	6,320	Tpa
Losses as CO2 emissions	25,888	t CO2 pa
N2O emissions	3,387	tCO2e pa at 310 GWP
On site plant energy emissions	83	t CO2 pa
Total emissions on site	29,350	tCO2 pa
Transport to site use	165	t CO2 pa
Total emissions	**29,523**	**t CO2 pa**
Avoided emissions (peat replacement)	**6,650**	**t CO2 pa**
Net emissions	**22,873**	**t CO2 pa**

5 Assessment of avoided emissions from recyclate use

material	% in waste	tpa present	capture	tpa available	tCO2 * saved/t material	tpa CO2
Al	0.30%	720	90%	648	1.346	872
Fe	1.80%	4,320	90%	3,888		
plastics						
thin film	3.40%	8,160	90%	7,344	1.66	12,191
dense	4%	9,600	90%	8,640	1.66	14,342
glass	5.40%	12,960	90%	11,664	0.33	3,849
CO2 saved tpa						**31,255**

** co-efficients drawn from Enviros report on resource efficiency and greenhouse gas emissions, report to Yorkshire Forward 2009*

6 Summary GHG balance for residuals treatment t CO2e pa

Parameter	Emissions	Avoided emissions	Net emissions
Collection	1,660		1,660
Autoclave, MBT activities	42,198		42,198
AD plant		9,486	-9,486
Compost maturation & use, transport to land	29,650	6,650	23,000
Carbon sequestration in land at 8.3%		5,590	-5,590
Recyclate re-use		31,255	-31,255
Totals	**73,508**	**52,981**	**20,527**

2.1.3 GHG emissions for materials recovery option

Total GHG balance for both treatment routes tpa CO2e

Treatment route	Emissions	Avoided emissions	Net emissions
Segregated food wastes	6,412	9,096	-2,684
Residual wastes	73,508	52,981	20,527
Totals	**79,920**	**62,077**	**17,843**

This analysis shows a very low net greenhouse gas emissions figure for the analysed system, with a total of nearly 18,000 tpa CO2e.

As an example it is worthy of assessment as it indicates how a materials rather than an energy approach to residual waste treatment can yield environmental dividends. It has the added advantages of meeting EU Directive 2008/98 and being implement-able on small low footprint sites around the County.

Further details of the calculation methodology can be provided on request.

2.2 Carbon balance for incinerator

CERC Carbon Balance

Please provide the calculations used to support the conversion factors and data supplied in this Report. It is recommended that this data be included as an Appendix to the report, or provided electronically to enable a sample of calculations to be assessed	It is the professional opinion of ERM, the applicant's consultant, that the report is supported by robust analysis. The calculations use emission factors from proprietary software, which ERM is not permitted to share with third parties; therefore the details of the analysis are not available

An analysis of the ERM Carbon Balance report has been carried out to investigate the background to this claim.

The software identified in the Carbon Balance report is shown below.

Emission factors calculations software used

2.2.1 Construction emissions

http://www.environment-agency.gov.uk/business/444304/502508/1506471/1506565/1508048/1883907/?lang=_e

The ERM report has an outdated link, the up to date link for the carbon calculation for construction emissions is
http://www.environment-agency.gov.uk/static/documents/carbon_calculator_2_1883909.xls

This an excel spreadsheet based tool of 0.75MB easily downloaded and freely available. The use of this tool can be seen in the following table copied from the Carbon Balance report   Not proprietary software.

- GHG Emissions from Construction: ERM report

GHG Impacts		***Adopted Approach***
Incineration (CERC)		
	Embedded CO2 emissions of the construction materials	*Estimated from amount of construction materials needed* *EA carbon calculator used for calculations*
	CO2 emissions from fuel used in the transportation of building materials from source to site	*Not included in calculations at this stage as information not available.*
	CO2 emissions from fuel used in the transportation of construction personnel	*Estimated from size and duration of construction* *EA carbon calculator used for calculations.*
Landfill (Connon Bridge)		
	CO2 emissions from construction	*Not included in calculations as landfill is in operation*

2.2.2 GHG emission factors for transport

The sources of the information in the ERM report are given as:-

(1) Source: Doka, Gabor (2006) *Transport, municipal waste collection, lorry 21t/tkm/CH*. Ecoinvent database in SimaPro LCA software, Life Cycle Inventories of Waste Treatment Services. The emission factor is for GHG emissions for every one ton of waste transported per km travelled.

(2) Source: Spielmann, Michael (2006) *Transport, lorry 32t/tkm/RER*. Ecoinvent database in SimaPro LCA software, Life Cycle Inventories of Transport Services. The emission factor is for GHG emissions for every one ton of waste transported per km travelled

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TCN Note

This software is proprietary and hence not available except to those who choose to pay for it. However equivalent information can be extracted from industry sources as undertaken by TCN in our submission in the summer of 2008. In addition it only covers the transport issue during operation of the incinerator and then only provides a number for the fuel use of each type of lorry in use by the incinerator, a relatively small part of the calculation. See references below for open sources for this information,

References from TCN First Submission for transport emission factors

- Volvo FM road test by Truck Trader from http://www.autotrader.co.uk/TRUCKS/news/reviews.2005-october.roadway-happy.htm truck tested at av 8.83 mpg, with 6.98 mpg on a rural route, and 9.42 mpg on the motorway

- AEA Technology Waste management options and climate change report to European Commission 2001. Final Report ED21158R4.1 p87 from http://ec.europa.eu/environment/waste/studies/pdf/climate_change.pdf
  table p87 shows
  waste collection vehicles 4.3 kg CO2/t with 40km distance and 6.67 t payload, giving 0.11 kgCO_2/tkm
  bulk transfer vehicles shown as 5t payload.

This is replaced with ERM Sita report of 12.17 t payload giving 0.058 kg CO_2/tkm

- Knipe, AD Comparison of greenhouse gas emissions from the centralised and household treatment of food waste, Environmental Research and Consultancy 2007
  Laden vehicle fuel efficiency 0.236 l/km
  Unladen vehicle fuel efficiency 0.104 l/km part load

- McKinnon, Prof Alan CO_2 Emissions from Freight Transport in the UK Report prepared for the Climate Change Working Group, Commission for Integrated Transport Heriot-Watt University, 2007
  Indicates small freight vehicles use 360 gm CO_2/t km at 8km/l fuel efficiency and HGVs produce some 138 gmCO_2/t km

- Dennis Eagle telecon Andrew Guy technical sales Phoenix Twin pack waste collection vehicle 20th June 2008
  Rural route fuel use c 4-5 mpg, urban route with hills example Torbay 2.5-4 mpg

Comparison of publicly available waste freight energy/CO2

truck			*Av mpg*	*Rural mpg*	*Motorway mpg*
Collection	*Volvo*		*8.83*	*6.98*	*9.42*
	Phoenix		*Urban with hills*	*4-5*	
	Twinpack		*2.5-4*		
	Knipe	*Laden*		*0.236 l/km*	
		Unladen		*0.104 l/km*	
	McKinnon	*8km/l*		*360gmCO2/t km*	
	AEA Tech	*110 gm t km*			
HGVs	*McKinnon*			*138 gmCO2/t km*	
	AEA Tech				

This gives a range of CO2/t km as shown below

CO2 emission factors for waste transport compared to ERM (hidden source) figures

Lorry type	gm CO2/t km	Source
RCVs	640	from Volvo fuel figures av 6.98 mpg with ERM figures for av distance and payload
	1,110	Phoenix Twin pack assume av 4 mpg
	417	Knipe laden mileage plus unladen for return trip
	360	McKinnon
	168	AEA Technology
Average	**539**	Weighted av removing hi and lo figures **472**
RTS lorry	221	McKinnon
	128	AEA Technology
	174	**Average**
ERM data from Carbon balance report table 1.5		
RCV	**1,258**	Ecoinvent
RTS lorry	**137**	Ecoinvent

This data shows a range of information with the ERM figure used for Refuse Collection Vehicles being higher than any found in the literature or in discussion with the industry. As the figure used for the RTS to incinerator vehicles is a little low this perhaps indicates a tendency to prefer the use of RTS vehicles and the proposed system structure of a number of RTS from, which waste is bulked up before transfer to the central incinerator rather than a decentralised system, using a higher percentage of RCVs.

The weighted average of RCV from industry figures for CO2 is some 472 gm/t km compared to the ERM use of 1,258 gm/t km some 2.7 times higher. Given the wide range of sources for the figures used in this Evidence the hidden source for the ERM figure does not appear credible and the calculations would be usefully redrawn with more credible figures, such as those derived above from open sources.

ERM calculation for transport emissions 3,298 t CO2 pa
They admit (personal communication C Larke June2008) that the transport calculation only includes one way travel.

The table below shows the stages of the calculation, using ERM figures for the mileages and tonnes carried to and from each type of destination, against the lorry weights given in the ERM Carbon balance report. The final two sets of columns show the different CO2 emissions for the two sets of derived emissions data from the ERM hidden sources and the TCN open sources noted above. The resulting tonnages are then multiplied by 1.6 to allow for the return journey (double the mileage) unladen.

2.2.3 CO2 emissions from transport to incinerator

Journey	Total journeys laden only	Total tonne km pa	CO_2 emissions calculated tpa CO_2			
	km pa	t km pa	using ERM figures		using public data	
			RCV	RTS	RCV	RTS
			*1.258**	*0.137**	*0.47**	*0.17**
WCAs	797,205	6,755,000	8,498		3,188	
HWRCs	147,770	765,450		105		133
RTSs	385,994	4,690,266		643		816
MRFs		5,085		0.70		1
Various recycling/disposal		176,410		24		31
Total	**1,330,970**	**12,392,211**	8,498	772	3,188	981
		total	9,270		4,169	
total including return journeys			**14,832**		**6,671**	

** kg CO_2/t km from previous table above*
RCV refuse collection vehicle
RTS refuse transfer station bulk waste transport vehicle to incinerator
It is noted that ERM have corrected their t km figures, but this makes little difference to the final figure as we are within 10%. At the start of the calculation. This table shows that the correct CO_2 emissions under the ERM emissions factor would be 14,832 tpa. However a more accurate figure for this aspect of the proposed system would be 6,671 tpa less than half that suggested.

2.2.4 GHG emissions from operation

A close scrutiny of the ERM Carbon balance report does not reveal the existence of any specialist or proprietary software. The calculation can easily be re-created in any spreadsheet program, such as Excel.

As expounded in our earlier evidence the more accurate method of comparing the two options of “do nothing” and the centralised incinerator treats both sides of the greenhouse gas emissions equation equally. This we do below and provide the scientific background for this approach as well as the complete methodology to allow scrutiny and verification.

The carbon balance of the incinerator proposal can logically only be fully compared by assessing the flow of all the carbon in the system, regardless of how is treated. The IPCC method of ignoring biogenic carbon incinerators is used only for greenhouse gas inventories, for a different purpose and with very different boundaries.

The present planning application has a very narrow focus, and hence for a complete understanding of the fate of the carbon must include all carbon within the system boundary, ie all the carbon in the 240,000tpa waste arisings under discussion. The atmosphere responds exactly the same to a molecule of CO_2 whether its source is fossil or biogenic.

PPS 1 states that climate change is a material consideration, so it is important that any comparison of treatment options provides a complete picture of all the carbon on a like-for-like basis.

2.2.5 Authorities for balanced GHG emissions methodology

A Include biogenic carbon in incinerator releases

1 International Panel on Climate Change

ERM are incorrect in calling on the authority of IPCC for not including biogenic carbon in their calculations. The IPCC guidelines state that biogenic carbon **should** be included when assessing greenhouse gas emissions from incinerators where energy generation occurs. What it states is quoted below. It is noted in two locations that whilst biogenic emissions are not included in the Waste Sector inventory they should be reported to the Energy Sector.

IPCC Guidelines for National Greenhouse Gas Inventories
Vol5 Wastes: Introduction

Incineration and open burning of waste containing fossil carbon, e.g., plastics, are the most important sources of CO_2 emissions in the Waste Sector. ***All greenhouse gas emissions from waste-to-energy, where waste material is used directly as fuel or converted into a fuel, should be estimated and reported under the Energy Sector****.* The guidance given in Chapter 5 of this Volume is generally valid for waste burning with or without energy recovery. CO_2 is also produced in SWDS, wastewater treatment and burning of non-fossil waste, but this CO_2 is of biogenic origin and is therefore not included as a reporting item in this sector. In the Energy Sector, CO_2 emissions resulting from combustion of biogenic materials, including CO_2 from waste-to-energy applications, are reported as an information item.*

Vol5 Wastes: Incineration and open burning

Emissions from waste incineration without energy recovery are reported in the Waste Sector, ***while emissions from incineration with energy recovery are reported in the Energy Sector,*** *both with a distinction between fossil and biogenic carbon dioxide (CO_2) emissions.*

Consistent with the 1996 Guidelines (IPCC, 1997), only CO_2 emissions resulting from oxidation, during incineration and open burning of carbon in waste of fossil origin (e.g., plastics, certain textiles, rubber, liquid solvents, and waste oil) are considered net emissions and should be included in the national CO_2 emissions estimate. The CO_2 emissions from combustion of biomass materials (e.g., paper, food, and wood waste) contained in the waste are biogenic emissions and should not be included in national total emission estimates. ***However, if incineration of waste is used for energy purposes, both fossil and biogenic CO_2 emissions should be estimated****.*

** author's emphasis*

2 ERM and Golder Associates Carbon Balances and Energy Impacts of the management of UK Wastes Defra R&D Project WRT 237 Final Report December 2006

In this report ERM as lead consultants include all carbon (fossil and biogenic) in the wastes studied for their carbon balances, both in incineration treatment and in landfill of biodegradable wastes. This research was commissioned by the Defra Waste Research Team, in a programme developed in response to an identified need for better coordinated waste related research in the UK. Its aim is "*to deliver a sound evidence base for better informed policy development, implementation, monitoring and evaluation for sustainable waste management at both the national and local levels, …*".

It is therefore illogical of ERM to insist that biogenic carbon should not be counted in the greenhouse gas emissions from the incinerator, when their work for Defra included it.

It may be worth noting in this context that this report by ERM has been reported in the literature in the following terms:- " *To the extent that the report was seeking to understand the potential for different technologies to contribute to delivery of the UK's waste strategy, then it is perhaps slightly unreasonable to compare a sub-optimal example of one technology with another technology (incineration) whose specification far exceeds what is usually reported in the literature.*

This – allied to the fact that the report ignores the inter-related issues of biogenic sources of CO_2, the effects of time, and the time-limited sequestration associated with biological treatments – implies that the study strongly favours thermal processes for the treatment of (residual) waste. "(reference 2 below)

This literature review suggests a pre-existing bias within ERM towards incineration as a method of treating waste. It might therefore provide a more scientific and hence reliable result if independent figures were used for this calculation.

3 Eunomia Greenhouse Gas Balances of Waste Management Scenarios Report for the Greater London Authority January 2008

Quote

The climate, …, responds no differently to fossil or non-fossil CO2, and thus it is important to include all emissions on a like-for-like basis where comparative analysis is concerned.

It should be emphasised that the argument for consideration of GHG emissions from non-fossil carbon is made within the context of a comparative study of residual waste treatment technologies only. This argument should not be taken out of context and is not intended to refer to any other areas, such as comparison of renewable energy sources with those from fossil fuels or the compilation of a GHG emissions inventory, which is usually undertaken according to IPCC conventions.

4 Peer review Mike Holland EMRC submitted to GLA Oct 2007

Quote

How do the methods used compare with published guidelines for greenhouse gas quantification?

Of particular note are the guidelines published by the IPCC (Inter-governmental Panel on Climate Change), which have been widely adopted for the development of national emission inventories and methods developed for life cycle analysis. The methods followed in the report clearly differ to those recommended by the IPCC and LCA conventions in several ways, most importantly:

*• Inclusion of emissions of biogenic carbon**.** The system boundary appropriate to the report is restricted to consideration of the emissions from waste management activities. Biogenic carbon can reasonably be excluded if the boundary extends to the farming and forestry practices that generate the biogenic carbon in the first place, as long as they are managed sustainably. Even then, however, as Hogg et al point out, care needs to be taken to ensure that factors such as the long-term sequestration of carbon are properly accounted for. A further factor is that the effect of a tonne of CO_2 will be the same, irrespective of its origin. This is not to argue that the approach used by Intergovernmental Panel on Climate Change (IPCC) and other lifecycle assessment (LCA) work is incorrect, simply that the boundaries applicable to the development of national inventories and to material-oriented LCA is different to an assessment based purely on waste management techniques*

5 ***US Environmental Protection Agency*** *Greenhouse gas emissions from management of selected materials in municipal solid waste. 1999*

6 *London's Food Sector Greenhouse Gas Emissions final report A Report for the* **Greater London Authority** *Brook Lyndhurst, Nov 2008*

7 ***Morris, J*** *Sound Resource Management Group Inc (1992) Recycling Versus Incineration. an energy conservation analysis. Journal of Hazardous Materials 47, 277-293.*

8 Biffaward Programme on Sustainable Resource Use Thermal methods of municipal waste treatment C-Tech Innovation Ltd

Authorities 2-8 include the biogenic GHG emissions from incineration as well as from landfill when assessing the comparison of the two treatment technologies.

B Include sequestered carbon in landfill in analysis

1 ***AEA Technology (2001) Waste Management Options and Climate Change: Final Report to European Commission, published by European Commission***

This report whilst not including biogenic carbon in the output of incinerators does include the sequestering of carbon in landfill sites on the grounds that some of the landfilled biomass only degrades, and is emitted, after the present 100 year time horizon is passed.

2 Biffaward Programme on Sustainable Resource Use Thermal methods of municipal waste treatment C-Tech Innovation Ltd

2.2.6 Issues surrounding biogenic carbon

D Hogg Eunomia Changing climate for waste, report to Friends of the Earth

This need not necessarily imply that energy from waste incineration is bad for climate change. It could, after all, be true that incinerating waste and generating energy from it is the best way of dealing with waste. This is the more-or-less unanimous outcome of the vast majority of studies which have looked at the matter from the perspective of life cycle assessment (LCA). However, we argue that the use of conventional LCA-based approaches, and most notably, the largely unquestioned assumption that 'biogenic carbon can be ignored' (or that only what is not liberated as CO_2 after 100 years needs to be taken into consideration, which amounts to a similar assumption), is inappropriate for this type of analysis. Ignoring what happens to biogenic CO_2 during a 100 year period can only be an acceptable way to proceed if all technologies behave in a similar way over this time period, and if society is not especially interested in the time profile of emissions. Neither would appear to be true.

The work, therefore, poses a challenge to those engaged in LCA-based work, pushing them to recognise the significance – as many have already done – of time. It suggests they must go beyond merely *recognising* time as significant, and actually integrate the dimension of time into the analysis. This is important not least since the European Commission has placed considerable emphasis, in the development of its proposals for a Thematic Strategy on Waste Prevention and Recycling and a revised Waste Framework Directive, on the issue of climate change, and on the use of 'life-cycle thinking'. In its current, conventional form, life-cycle *assessment* is not a reliable indicator of the contribution of waste treatments to climate change.

The significance of this is that the alternative methodology used in this work – based upon evolving thinking on the application of cost-benefit analysis to the problem of climate change – clearly highlights the fact that how a technology performs in respect of climate change is not simply a function of how much energy is generated. Once biogenic carbon is included explicitly in the analysis – which it must be unless we take the absurd assumption that the climate responds differently to biogenic and non-biogenic CO_2 molecules – then the effects of sequestering carbon, biogenic and otherwise, and of stabilising potentially methanogenic fractions (where landfill gas captures are not assumed to be unrealistically high) become important.

Suddenly, generating energy is not 'all that matters', and issues such as carbon sequestration begin to matter. Closer inspection also shows that capturing materials for recycling from residual waste also has a positive impact, and that developments which enable this to happen (especially for plastics) are likely to be beneficial. The effects of stabilising biodegradable elements of waste have also been used in the report to argue for a lower rate of landfill tax for stabilised bio-wastes (a development which would reduce the costs to local authorities of – and speed up compliance with - Landfill Directive obligations).

The Intergovernmental Panel on Climate Change appears to have no mechanism to understand the implications – for the release of CO_2 from biogenic sources – of a wholesale switch from, for example, landfill to incineration. Waste, and energy from waste, inventory data include only non-biogenic elements other than where the emissions are of methane. Quite clearly, a switch from landfilling biogenic carbon, in which process, biogenic carbon stays in the ground over a period of many years, to incinerating it, a process which liberates the vast majority of biogenic carbon as CO_2 immediately, ought to register some interest. It is not clear how, under existing inventory guidelines, it will do so.

The practise to disregard biotic CO_2-emissions can lead to erroneous results (Dobson 1998). Let us consider an example to illustrate this. Let us compare incineration and landfilling of a hypothetical product consisting of only cellulose. When incinerated, nearly 100 % of the carbon is emitted as CO_2. However, in the inventory, this emission is often disregarded as noted above. If the product is landfilled, approximately 70 % of the material is expected to be degraded and emitted during a short time period, mainly as CO_2 and CH_4 (Finnveden et al. 1995) (The short time period is here defined as the surveyable time period, …). Again the emitted CO_2 is normally disregarded, although the CH_4-emissions are noted. During the surveyable time period, 30 % of the carbon is expected to be trapped in the landfill. There is thus a difference between the landfilling and the incineration alternatives in this respect, in the incineration case all carbon is emitted, whereas in the landfilling case some of the carbon is trapped. ***This difference is however not noted, since the CO_2-emissions are disregarded*** and this is in principle a mistake. *Additionally, the biological carbon emitted as CH_4 in the landfilling case is noted and will discredit this option. It could be argued that a part of the global warming potential, corresponding to the potential of the same amount of biological carbon in CO_2, should be subtracted from the landfilling inventory.*

ERM comments on biogenic carbon as a long term carbon sink.
(2.2.3 of ERM reply to TCN objections October 2008)

TCN is not attempting to propose that Cornwall should encourage landfill as a method of sequestering carbon in the long term. It is well known that there are numerous problems with landfill as ERM indicate and that the timing of the carbon sequestration In landfills has some uncertainties. The calculations above, aim to take this uncertainty into account by using a low sequestration level taken from the literature (AEA Technology 2001)

TCN merely points out that the trapping of carbon in landfill for some years has the effect of reducing the immediate impact of the waste material on the global atmosphere, which occurs in full measure when the waste is burnt in a mass burn incinerator. Landfill delays this impact by a significant margin. Taking this into account provides a truer picture of the global impacts of the options detailed and should therefore be considered in the decision process

2.2.7 Calculation of carbon emissions in operation

ERM proposal on incinerator operational emissions following TCN's earlier submission

<table>
<tr><th>Source</th><th>Using total carbon</th><th>Using fossil carbon</th></tr>
<tr><td>Carbon input to incinerator</td><td>51,624</td><td>16,800</td></tr>
<tr><td>Emissions produced</td><td></td><td></td></tr>
<tr><td>CO_2 output</td><td>189,288</td><td>61,601</td></tr>
<tr><td>N_2O output</td><td colspan="2">3,720</td></tr>
<tr><td>CH_4 output</td><td colspan="2">1</td></tr>
<tr><td>Imported energy CO_2 emissions (from electricity)*</td><td colspan="2">280</td></tr>
<tr><td>Imported energy CO_2 emissions (from fuel oil)</td><td colspan="2">788</td></tr>
<tr><td>CO_2-eq from treating secondary aluminium</td><td colspan="2">808</td></tr>
<tr><td>Total CO_2 emissions (1)</td><td>194,883</td><td>67,197</td></tr>
<tr><td>Avoided emissions</td><td></td><td></td></tr>
<tr><td>From electricity generated (2)</td><td colspan="2">65,545</td></tr>
<tr><td>From heat sold</td><td colspan="2">3,478</td></tr>
<tr><td>From recyclates use</td><td colspan="2">11,861</td></tr>
<tr><td>Total avoided emissions</td><td colspan="2">80,884</td></tr>
<tr><td>Net GHG emissions from incinerator</td><td>113,999</td><td>-13,687</td></tr>
</table>

(1) TCN's total here was incorrect

(2) This reflects the use of updated 430 g CO_2/kWh emission factor

Now that ERM have agreed to use the correct figure for avoided emissions from electricity sent out, TCN's figures are only marginally different for the production of net emissions from the incinerator using all carbon input.

2.3 Carbon emissions from Landfill option

The table below show the landfill emissions as calculated by ERM in their October 2008 report.

ERM calculation on landfill emissions

Parameters	Estimated	Comments
Amount of CH_4 generated (from landfill gas)	7,587 tonnes CH_4/yr	-
Amount of CO_2 generated (from landfill gas)	20,865 tonnes CO_2/yr	-
Amount of CH_4 recovered	6,449 tonnes CH_4/yr	85% recovery rate
Amount of CH_4 oxidised	114 tonnes CH_4/yr	-
Electricity generation from landfill gas engine	11,772 MWh/yr	Installed capacity = 4.65MW, 7446 hrs/yr, 34% efficiency
Emissions from landfill		
CH_4 in escaped landfill gas	1,024 tonnes CH_4/yr	-
	21,510 tonnes CO_2-eq/yr	Included in carbon balance
CO_2 from burning landfill gas in engine	2,178 tonnes CO_2/yr	Not included in carbon balance (short-term carbon)
Avoided emissions		
Avoided emissions from electricity [(2)]	5,062 tonnes CO_2/yr	Included in carbon balance
Net emissions from landfill (excluding sequestered carbon)	16,448 tonnes CO_2/yr	-

(1) Units of tonnes of CO_2-eq/yr, unless stated.
(2) Using 430 g CO_2/kWh.

2.3.1 Areas of difference with ERM

1 Electricity generation from landfill gas

ERM suggest an installed capacity of 4.65 MW operating for 7,446 hours pa. At the national average of load factor for landfill with new disposals of 90% (Renewable Energy Foundation: Landfill gas presentation 2007) this would yield some 31,116 MWh pa electricity. Or at 100% Load Factor this would yield 34,624 MWh pa

However their figure is 11,772 MWh. It appears that they have double counted the system efficiency (quoted as 34%) to arrive at 34% of 34,624 ie some 11,772 MWh. To estimate electricity generation it is necessary to **either** take the installed capacity and multiply by annual hours (assuming correct capacity is installed) **or** take the energy available and multiply by the system efficiency. This latter approach, when divided by the running hours expected, gives the expected installed capacity.

This is an error in their calculation

A more accurate starting point would be the energy available in the captured gas. The table below works through the logic of electricity generation from the expected landfill gas.

Electricity from landfill gas

Parameter	ERM	TCN	Units	Proposed to use[1]
Amount of CH_4 recovered	6,449	5,814	Tpa	5,814
Energy in recovered CH_4	66,281*	59,755	MWh pa	59,755
Efficiency of generation	34%	38%	%	34%
Electricity generated at 90% Capacity factor	20,282	20,436	MWh pa	18,285
ERM Oct 08 elec. generation	11,772		MWh pa	
Proposed generation figure				**18,285**

** not provided by ERM so calculated from CV of 37MJ/kg*
1 aiming to use figures detrimental to TCN case

It is proposed to use the figure of 18,285 MWh pa for electricity generated in the landfill option

2 Emissions from landfill

Parameter	ERM	TCN	Units	Proposed to use[1]
Methane to gas engine	66,281	59,755	MWh pa	59,755
CO_2 to gas engine in LFG	?	8,343	tpa	8,343
CO_2 from CH_4 combustion	2,178	15,989	tpa	15,989
Escaped methane	1,024	684	tpa	1,024
Escaped methane as CO2e	21,510	14,364	tpa	21,510
Total emissions from landfill				**45,836**

1 aiming to use figures detrimental to TCN case

It is proposed to use the figure of 45,836 tpa CO2e for landfill emissions

3 Avoided emissions

Parameter	ERM	TCN	Units	Proposed to use
Avoided emissions from electricity generation at 430g/kWh	5,062*	8,787	tpa CO_2	**7,862**
Carbon trapped in landfill over 100years				8.3%[1]
Carbon sequestered in plastics etc ie fossil carbon	N A	16,794	tpa C	16,794
Carbon not otherwise accounted for			tpa C	24,287
Biogenic sequestration at 8.3% pa			tpa C	2,016
Biogenic carbon sequestered as CO2			tpa CO_2	**7,391**
Fossil carbon sequestered as CO2			tpa CO_2	**61,758**
Total avoided emissions			**tpa CO_2e**	**77,011**

** this is low as a consequence of the error on electricity generation*
1 from AEA Technology : (2001) Waste Management Options and Climate Change: Final Report to European Commission, published by European Commission
NA not available

The proposed figure for avoided emissions from the landfill option is therefore 77,011 tpa CO_2e

This figure has been arrived at following an extensive literature search and assessment of the authorities in the field.

2.4 Summary of GHG emissions from treatment options

The arguments have been made on why the greenhouse gas balance should include the fate of all the carbon being treated by the options under discussion. The impact on actual greenhouse gas emissions of each treatment option is summarised in the table below.

Emissions for each option tpa CO_2e (avoided as -)

Emissions activity	Incinerator	Landfill	Materials recovery
Transport	6,671	6,671	3,000
Processing operations	194,883	45,836	76,920
Processing avoided	- 69,023	- 7,862	- 24,606
Disposal/final use avoided	- 11,861	- 69,149	- 37,471
Total balance	**120,670**	**- 24,504**	**17,843**

This table shows that the landfill option is the only one with a net greenhouse gas balance which is positive, largely because of the carbon which is left in the ground trapped in plastics and such like materials. The incinerator on the other hand, by taking the energy out of each of the carbon containing materials, releases that carbon into the atmosphere as CO_2 and hence provides an immediate and long lasting boost to local greenhouse gas emissions totalling some 120,000 tpa.

The incinerator releases 3 million tonnes extra CO_2 e over 25 years from its operations, and compared to the landfill option releases an extra 3.6 million tonnes CO_2 e over the same period.

Both of the other options provide a much lower impact on greenhouse gas emissions with the materials recovery option also providing both significant value in terms of recycled materials for use and some local energy value.

PPS1 states that climate change is a material consideration. Planning authorities are required to prepare spatial strategies which "*secure the highest viable resource and energy efficiency and reduction in emissions"*; From the above analysis it is clear that the proposed incinerator does not meet this requirement, and the Application should therefore be refused.

3 Non-compliance with National Waste Strategy and Need Assessment

Percentage recycling and composting

ERM maintain that TCN has mistaken household waste for MSW in the definition of the waste counting towards recycling and composting targets. This is true. However a closer look at the ERM report in October 2008, suggests that ERM is only making an assertion in its statement that the recycling targets will be met, with an incinerator in place in Cornwall.

This assertion has no facts or plans to back it. The *Task 1 Need Assessment report* seeks to make a case that the recycling targets will be met purely through reference to a number of scenarios, at various levels of recycling up to national targets.

There are no plans proposed for how Sita as the MSW contract holder and Applicant for the incinerator intends to meet the recycling targets and no suggestion that they will be putting in place any system or process to achieve this.

Given that fact that most objectors to incinerators do so partially on the grounds that this technology competes for the waste with recycling and composting, this is a major omission in the Need Assessment.

Another major omission in this Need Assessment is any awareness of the changing policy background in waste issues in Europe, nationally, regionally and locally. For example the new EU Directive 2008/98 EC requires Member States to legislate for separate collection and treatment of food waste within two years of the Directive ie by 2010.

Whilst it is not expected that the report which came out before this Directive was finalised, will fully be able to evaluate its impact, it would be expected that a company such as Sita with its resources and wide geographical range of waste contracts would be aware of upcoming legislation in Europe.

The table below shows how targets for recycling and composting of MSW have been changing over time and always increasing in line with increased awareness of environmental issues. Awareness of this trend, its drivers and its timetable should enable any waste company to prepare robust recycling plans, which accurately assess need against the changing policy background.

Changes in Targets for recycling over time

Source of target	**Year target set**	**Target yr**	**% recycling/ composting required**
White Paper on Environment	1990	2000	25%
DoE Making waste work, 1995	1995	2000	25%
DoETR Waste Strategy 2000	2000	2005	25%
		2010	30%
		2015	33%
SW Regional Assembly Waste Strategy	2004	2020	>45%
Defra Waste Strategy 2007	2007	2010	>40%
		2015	>45%
		2020	>50%
EU Directive 2008/98	2008	2020	50%

MSW arisings in Cornwall are some 297,777 tonnes in 2007/08 (*Recycle for Cornwall website*), meaning that the expected MSW arisings in 2020 on which the need for the incinerator is based require an increase of 1.25% pa until then.

However the present economic situation is having a dramatic impact on all levels of economic activity. Waste statistics and material flow statistics for the UK show evidence of reduced materials use as well as reduced waste arisings in times of recession (*Office of National Statistics UK material flow 2005*), shows dips in waste in recessions in the 1970s and the 1990s. The UK and indeed the world is in the grip of a major recession at present with some authorities suggesting the economy will take some years to recover (*Bank of England Quarterly Bulletin 2008 Q4*), with market analysts indicating that relative company earnings will be negative for three years or more (*chart 23.*) These statistics suggest that there will therefore be a flattening of MSW arisings in Cornwall over the next few years. This background coupled with the requirement to collect and treat food waste separately indicates that there a strong possibility of a lack of feedstock for the proposed incinerator.

For example a reduction of 1.5% pa for three years in MSW from the present time would yield around 284,500 tonnes of which the expected food waste would be some 50,000 t, garden waste 60,000 and paper/card, glass etc being recycled under present arrangements would total lower than now at 70,000 t. This leaves only around 133,000 tpa available for the incinerator, assuming that the recycled and composted fractions decrease in a similar way and that food waste is 62% captured in separate collection as noted in the earlier section on carbon balance. The new Audit Commission report (*Well disposed Sep 2008)* indicates that *"Around 70 per cent of household waste is readily recyclable".* If appropriate plans were made for this percentage recycling within Cornwall then only 86,000 tpa would be available to the incinerator and a large proportion of that would be non-combustible.

Although it is noted that Sita would like to make provision for some commercial and industrial waste to be burnt in the incinerator this is not given as the main driver for the Application. In the situation outlined above, the present recession and possibly good recycling activities by the Council, lead to a lack of feedstock for the incinerator and only some 55% of the capacity would be used for the purpose for which the facility is supposed to be built.

It is clear from this that the Need case for the incinerator has not been made.

On these grounds the Application should be refused.

4 BPEO and Waste Local Plan are flawed

ERM seeks to discredit the work input by TCN in summer 2008 by not being able to find the anaerobic digestion figures quoted by TCN in their own work. However the report being quoted from, and which is flawed in many aspects, is the original BPEO undertaken by AEA Technology and referenced in the original Objection.

The AEA Technology BPEO was "assessing" several scenarios for the treatment of MSW, and hence the comments made on the figures which were wrong in this report are correctly made.

The point continues to be made that the Waste Local Plan, is a flawed document. Although it was accepted by the Inspector, this was without the knowledge that within the report there are major flaws.

The Waste Local Plan has largely been overtaken by policy changes at a higher level, (as noted in our previous submission) and hence cannot be regarded as the main parameter for the decision process.

5 WRATE reports

CCC Request for further information

Please clarify whether there has been a peer review of the "WRATE" analysis used in this section, and/or whether the Environment Agency is able to verify the comments made in this analysis.

SITA response via T O'Rourke

Although the applicant has internally checked the WRATE analysis, there has been no external peer review of the calculations. The Environment Agency tends only to get involved in this process when new processes are designed, that the technology providers wish to be made widely available to all WRATE users. The Environment

Agency does not perform peer reviews of options appraisals and similar studies such as this one. The applicant would also point out that their consultant, ERM, was jointly responsible (with the Environment Agency) for developing the life cycle models that underpin WRATE, and that any new licence holder is offered training delivered on behalf of the Environment Agency by ERM. For these reasons, the applicant considers that they have had access to an unparalleled knowledge of the WRATE software, and therefore confidence that the analysis is sound

Review of WRATE reports must be done externally and the statement that because ERM helped develop the tool they are to be unquestionable experts in applying it does not necessarily follow through – expertise can be lost and even the developers themselves do not always understand the results of their software – even less are capable of correctly interpreting them. ERM developed the tool in association with other consultancies – Golder Associates for example.

The key problems with the ERM report is that there appears to be no appreciation of CHP – and no assumptions made in light of this for small or large facilities. Heat use assumptions should be made based on actual CHP feasibility studies done for each potential site (again by externals) so they are Robust . The use of heat is very important in WRATE particularly regarding abiotic resource depletion and global warming potential.

Also the ERM report lacks detail on how the transport impacts were calculated. Methods can differ widely. It is unclear how WSP can calculate that five incinerators have a lower decrease in transport than two incinerators. Also the stated point that some incinerators are assumed over capacity and some under is weak – from an operational point of view this is most sub-optimal. Sources of waste should be allocated to each plant in order to meet capacity thresholds. Again – a description of how they calculated these impacts would be useful.

Also in order to meet the ISO 14040 (International Standard for Life cycle analysis) the software has adequate tools for peer review (ie fields of assessment that should be typed out) – if this has been done properly it should also be published publicly.

There is no such transparency with this report. Another study should be done by an external, ideally with CHP feasibility studies for each site to inform the WRATE modelling. The two studies should then be compared and evaluated publicly for transparency.

Quotes from Inspector's report when refusing an appeal for an incinerator in Kent

The appellant's BPEO assessment used the Environment Agency's software tool, WISARD and considered five options, based in the first instance, on managing *municipal waste arisings from north Kent. The options involving energy from waste (i.e. the appeal proposal and the permitted plant at Allington) achieved the highest scores, with the appeal proposal being preferred. However, given the subjective nature of such assessments and the fact that they do not provide absolute scores, the result was too close to rule either out as representing the BPEO.*

Quote from A Changing Climate for Energy from Waste? Final Report for Friends of the Earth, Eunomia 2006

Would be users of the successor to WISARD, WRATE, may wish to be aware of some of the shortcomings in the datasets highlighted above, and some of the assumptions being made. The report notes for each treatment that: Data for the inputs and outputs associated with the treatment of waste via [[for example, anaerobic digestion] were generated using data the Environment Agency have collected (2003-2005) for waste management processes in support of the development of WRATE.

Unless considerable revision of the data has occurred subsequent to the report being written (which might be considered unlikely given its recent vintage), then decisions made on the basis of WRATE are likely to be no more robust to challenge than those based upon its predecessor

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