

Managing Organic Waste – does Anaerobic
Digestion hold the key

**BMW as an input for AD - the technology,
fuel preparation, waste and output balance**

SITA UK

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Introduction

The intention today is to focus on the need to think slightly differently, to consider all the flows and issues before you start picking location, feedstocks, energy use and end markets

- To consider how best to get the optimum feedstock out from the producers
- To consider what types of technology are optimum for your defined needs and requirements
- To consider location of facility to meet your energy use expectations and your digestate and oversize end market solutions

Conceptual thinking

- **Think Fuel not waste**

- A good 'engine' will have less performance and be more unreliable when using a poor quality fuel
- A poor 'engine' will have less performance and be more unreliable whatever the fuel quality relative to a good engine

- **Think Engine** – eg,- Is your driver throughput or maximum yield ?

- High throughput might warrant less residence time and therefore less yield
- Low throughput could achieve more yield through higher residence time

- **Think Output**

- Electricity is less location dependent
- Heat is very location dependent

- **Digestate** –

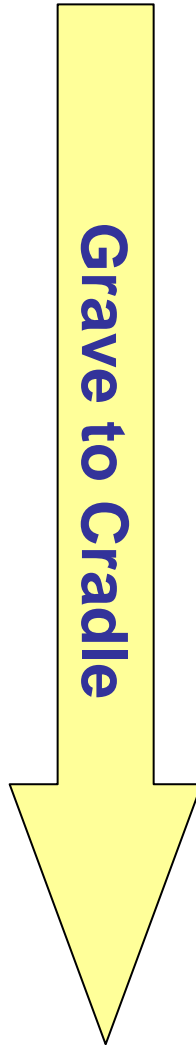
- Agricultural Land spreading – Para 7 exemption – not if no source segregation
- RDF – fuel consistency and quality for end user – Market ?
- Landfill – LATS impact for residual



Cradle to Grave

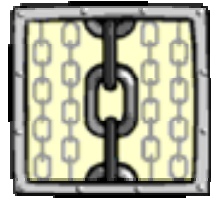
Conceptual planning

- **What do you mean by BMW for your project**
 - Green waste ?
 - Kitchen waste ?
 - Green and Kitchen ?
 - Co-mingled MRF output ?
- **Mix changes in year and over years**
 - Does it change seasonally ?
 - Will it change over the years of the project ?
- **Technology to fit**
 - The 'fuel' you want to use
 - And the quality of the 'fuel' over the time you want to use it
- **LATS diversion –**
 - What are you trying to achieve and when ?
- **Location**
 - Electrical users – heat sinks (nearby)
 - Digestate – availability of land for spreading, RDF users, Landfills



Full chain not half chain

- **If you don't get your conceptual chain sorted you could**
 - Find no heat use locally
 - Develop a plant in a nitrate restricted zone
 - Have a digestate that can only go to landfill
 - Pay loads for your electrical connection and find gas yields are poor so you only utilise half the capacity
 - Suffer capacity problems at peak input times when retention times are reduced, yields reduced and digestate quality suffers
 - Have reduced yields of gas due to partial decomposition in collection bins (that may be 14 days old at delivery)
 - Etc.....



The 'Fuel' choice

- **What can normally be digested**

- Mixed household waste after pre-processing
- Source segregated organic fractions of household waste
- Garden waste
- Market wastes
- Waste from certain local food processors (be careful with ones that might generate on their own or in the mix H_2S)



- **What cannot normally be easily digested**

- Lignite/cellulose based wastes
- Plastic (remember biodegradable might mean aerobic)
- Batteries, textiles,

- Source separated food waste could give yield of $120Nm^3$ biogas per t
- Poor Post co-mingled sorting of the organic fraction could give yield of $60Nm^3$ per t

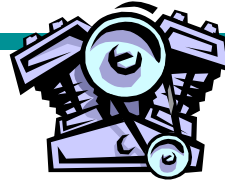
The 'engine' choice

Who is buying what ?

october 2006	plants	inhab. (millions)	plants/inhab A	tons (x1000 t)	tons/inhab B	Present situation (= A*B)	Future developm.	Remarks
Germany	48	82	0,59	1600	19,51	11,4	+	MBT (mainly) + biowaste
UK *	2	60	0,03	45	0,75	0,0	++	MBT (mainly) + biowaste
France	5	64	0,08	285	4,45	0,3	+	MBT, biowaste
Italy	5	58	0,09	214	3,69	0,3	-	cheap alternative solutions
Spain	22	44	0,50	1248	28,36	14,2	++	MBT, biowaste
Poland	2	38	0,05	32	0,84	0,0	-	rather co-digestion plants (liquid)
Netherlands	4	16	0,25	262	16,38	4,1	-	European landfill objectives already met
Belgium	3	10	0,30	130	13,00	3,9	?	European landfill objectives already met
Sweden	2	9	0,22	26	2,89	0,6	-	rather co-digestion plants (liquid)
Austria	4	8	0,50	55	6,88	3,4	+	MBT + refurbishing composting biowaste
Denmark	2	5	0,40	35	7,00	2,8	-	rather co-digestion plants (liquid)
Finland	1	5	0,20	15	3,00	0,6	?	MBT
Luxembourg	1	0,5	2,00	25	50,00	100,0	-	rather co-digestion plants (liquid)
Australia	2	20	0,10	210	10,50	1,1	?	MBT, biowaste
Switzerland	15	7	2,14	167	23,86	51,1	+	small biowaste plants (MBT forbidden)
CZECH rep.	0			0		0,0	+	European targets + national strategy

* -UK 2007 update – 10 plants and 227ktpa capacity – third party source

The 'engine' choice



Feed stock technology considerations

	1	2	3
Type of waste	Biowaste	Organic fraction from MBT	Organic fraction from MBT
Target	Produce compost	Stabilisation before landfill / RDF	Produce compost
Suggested process	Dry process	Drying process without mechanic mixing mechanic of the digester	Humidity process with intensive pre-treatment
Example providers	Linde (dry)	OWS	Ros Roca
	Take care with issues on land spreading assumptions		Take care with issues on land spreading assumptions

The 'energy' choice ₁

An example 40,000 tpa source segregated feedstock site could produce gross 9350MWh/yr of electrical energy and 10,300MWh/yr thermal

Net Electrical export would be around 7950 MWh/yr and heat 9,700 MWh/yr

Electrical value (approx values)

Brown power (£30MWh) = £285k/yr

Lec (£4.3MWh at 85%) = £ 29k/yr

ROC (£42MWh current) = £334k/yr

ROC_a (£42MWh RO review) = £334k/yr

TRIAD's = £?

ROC_a – assumes 2 ROC per MW band

If mixed with say sewage sludge then we understand low band (0.25ROC/MW) may apply

HEAT value (approx values)

Lower bounded (£15MWh) = £194k/yr

Upper bounded (£40MWh) = £ 388k/yr

Location is **so** important that without identifying your source at initial stage assume zero revenue. Heat market is very immature and prices are very volatile by location, user and need.

If you have a MRF on the site for co-mingled MSW and include its parasitic electrical load, energy potential could fall to 6,000MWh/yr (lower fuel quality than source segregated) and net export fall to 3,240MWh (higher parasitic) reducing electrical sales income by 30-60%

The 'energy' choice ₂

An example 40,000 tpa source segregated feedstock AD might cost in the region of £8-£10M depending on the civil engineering and land costs

For the purposes of the calculation I will assume £10M capex and 20 year asset depreciation and an 'average year' and all pre processing costs are funded elsewhere. This calculation is an example using average assumptions and real case projects will vary in both costs and revenues, it excludes tax and other deductions and therefore should be indicative only.

Assumed Total costs (avg year) = £1,520 k/yr

Income (best – SS, high heat and gas yield)

Electricity = £ 982 k/yr

Heat = £ 388 k/yr

Total = £1,370 k/yr

Relative* gate fee support 11%

Income (lower yield no heat sales)

Electricity = £ 687 k/yr

Heat = £ 0 k/yr

Total = £687 k/yr

Relative* gate fee support 121%

Income (Worst no heat and MRF feedstock, low gas yield)

Electricity = £ 490 k/yr

Heat = £ 0 k/yr

Total = £490 k/yr

Relative* gate fee support 210%

* Relative to the energy revenues only

200% relative difference between best and worst case shows importance of understanding fuel quality and heat supply opportunities

The 'uncomfortable' options

• How to deal with residues/digestate

▪ Spread to Agricultural land

- > Only with source segregated feedstock at this time
- > Only with sufficient land available
 - For a 40ktpa plant potentially producing 4ktpa of digestate there would be a requirement for around 90ha of suitable land with a 250kg/N/ha/yr load or if NVZ proposed changes of 170kg/N/ha/yr are adopted then 132ha
 - What happens if you are in a nutrient poor heathland area where areas of potential application are limited ?

▪ Spread for non Agricultural land improvement

- > What land is available and who else wants to use it

▪ RDF

- > Available sources are limited in most areas, will new markets develop ?
- > Can you achieve a consistent quality standard,
- > Does your production profile match their usage profile, stocking issues ?
- > Transport issues

▪ Landfill

- > LATS impact potentially, timing and scale
- > Location to nearest landfill, transport costs



Diversion targets – short – long term

- **What can be potentially diverted** (approximate figures inc MRF, oversize allowance and residuals allowance)
 - **AD with digestate to land**
 - > 90+%
 - **AD with residues to RDF**
 - > 85-90%
 - **AD with digestate to landfill**
 - > 45-75%

Example of Options that could be considered	Total BMW	BMW to landfill	Diverted BMW
Biostabilisation through AD, oversize and residues to landfill	80ktpa	29ktpa	51ktpa
Biostabilisation through AD, oversize split between landfill and market, residues to landfill	80ktpa	16ktpa	64ktpa
Biostabilisation through AD, oversize asplit between landfill and market, 33% of residues to RDF rest to landfill	80ktpa	12ktpa	68ktpa

Panacea

Maximise energy output uses to get highest efficiency – find a heat sink !

With CHP you can achieve efficiencies of 85% for energy use, with electricity only you are unlikely to exceed a 40% efficiency.

What you put in controls what you get out, source segregated bio-waste only is optimum, everything else is a compromise which is manageable but will have implications on yield, commerciality and end markets.

Its not without its risks – understand ATEX and its implications at the design stage for the whole facility, don't just rely on the technology provider.



Commercial thinking

Maximise the feedstock quality to get the best 'fuel'

Determine the optimum way of fuel preparation (source seg ~ sort) to your source profile

Buy the best 'engine' for your optimum 'fuel'

Locate your facility

- Near a suitable and reliable heat sink to sell the heat

- In an area where your residues/digestate can be best managed for the full project period

 - Near farming land with nutrient requirements and sufficient area

 - Near a RDF user to minimise transport

 - Near a landfill that can use the material

Sustainability thinking

Maximise the feedstock quality to get the best 'fuel'

Determine the optimum way of fuel preparation (source seg ~ sort) to your source profile

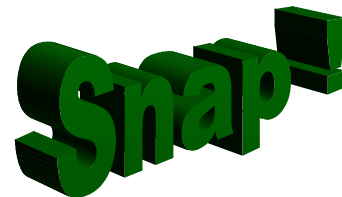
Buy the best 'engine' for your optimum 'fuel'

Locate your facility

- Near a suitable and reliable heat sink to use the heat

- In an area where your residue/digestate can be best managed for the full project period

 - Near farming land with nutrient requirements and sufficient area
 - make RDF near a user to minimise transport
 - or go to a landfill that can use the material



Conclusions

Think through the whole process flow not just part

Consider the commercial and sustainability flows for the process at the start

Choose your feedstock (fuel) carefully considering your needs in priority order

Choose your location considering your priorities

Choose the best technology for your defined feedstock, priorities and location

Accept the AD technology is only part of any solution

Thank you

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