2011 Briefing Report:

The Future of Landfill?

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TOLVIK CONSULTING

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CONTENTS

EXECUTIVE SUMMARY

- This Briefing Report provides an independent assessment of the future for the non-hazardous landfill market in England in the period to 2020.
- Until recently the landfill market bore an uncanny resemblance to the oil industry with a fear that the capacity would soon run out and that something had to be done urgently. As recently as 2007 the EA was suggesting capacity could be exhausted by 2015. In reality remaining void is diminishing relatively slowly and whilst there has been a very significant reduction in landfill inputs (down by 45% since 2000), the reported void capacity has fallen by just 21% over the same period.
- As a result, **using current inputs as the metric** (which is over-cautious given projected further reductions in volumes to landfill) **total landfill life in England by the end of 2010 is estimated to be just under 11 years**. There are regional variations, but such differences are less marked than five years ago as recent Residual Waste Treatment Capacity (RWTF) has in general been developed first in areas with lower landfill availability.
- In September 2010 DEFRA reported that, using the wider European definition of municipal waste and helped by the effects of the recession, in 2009 England had easily **met the 2010 Landfill Directive target of 21.8Mt** – sending just 14.6Mt of biodegradable municipal waste (BMW) to landfill. Whilst final data is awaited, **the 2013 target is expected to have been met in 2010.**
- Projecting forward to 2020, future tonnages of BMW to landfill will be a function of waste arisings trends, recycling performance, and the rate at which additional RWTFs are constructed. If it is assumed there is no significant 'post recessionary' bounce in waste volumes, a 50% household waste recycling rate in 2020, and recent improvements in recycling across the rest of the municipal waste sector are maintained, then modelling suggests, somewhat surprisingly, that the **2020 Landfill Directive target could just be met in England with no additional RWTF development**.
- However, if the current slowdown in the improvement in recycling rates continues, then **325kt of new RWTF capacity will need to be delivered each year** from 2011 so as to ensure that the 2020 Landfill Directive is met - the "Do Minimum" scenario. This is broadly equivalent to three 'standard' sized EfWs (of 250ktpa) being constructed every 2 years.
- If, on the other hand, **the summer 2011 level of RWTF construction activity can be maintained** (the equivalent to a run rate of 550kt of new RWTF capacity each year), then by 2020, 33% of the identified planned RWTF capacity in England would have been developed. In this "Central Case", **England would beat its Landfill Directive target for 2020 by 3.5Mt of BMW.**
- On balance therefore, whilst there is no reason to be complacent, it is difficult not to conclude that, helped by the change in the definition of municipal waste, **England is on track to comfortably meet its 2020 Landfill Directive target.**
- In this Central Case, landfill inputs are projected to fall by 45% over the next 10 years – if so the **Central Case would show an almost identical rate of decline in landfill inputs as that seen over the past 10 years.** However, in such a scenario, England's reliance on landfill would continue to be greater than most of northern Europe and overall would be still be some way short of Government's longer term 'zero' waste objectives.
- Whilst further falls in waste tonnages to landfill beyond 2020 are probable, with landfill becoming the disposal point of last resort for most residual wastes, there will always be a portion of wastes for which landfill is the most appropriate option. It is therefore important that landfills remain economically sustainable.

- Faced with ongoing declines in inputs, with landfill operators fighting to maintain volumes, it would be reasonable to expect that spot landfill gate fees would fall from the current reported national average of around £20/t. However, Tolvik's analysis shows that for most landfills declining inputs will mean that **reducing average gate fees to £13-£15/t is unlikely to be economically sustainable.**
- Evidence from mainland Europe would suggest that as inputs fall, so the number of operational landfills decline and average inputs per site are maintained. Not all closed landfills will necessarily have exhausted their void capacity, **rather it is likely that capacity will be actively managed by larger operators through mothballing uneconomic sites**. By 2020 it is projected that there will be about 55 remaining operational landfills in England – the equivalent to one per county.
- In the Central Case, therefore, whilst landfill gate fees are expected to come under pressure in the very short term (not so much through competing with RWTFs but more through competition between sites), **in the medium term a recovery in gate fees is projected to more economically sustainable levels**.
- Somewhat counter-intuitively, if the declines in landfill inputs are more modest than those projected in the Central Case, there is the potential for landfill gate fees to fall further, as the pressure on operators to actively manage void will be less clear cut.
- There is little doubt that landfill operators face a challenging future but that the key to maintaining a profitable landfill business will be to carefully monitor the local market, maintain dialogue with the regulators, actively manage void (and cost base), and where possible identify additional revenue opportunities for the site.

1. INTRODUCTION

1.1. Background

The UK is rapidly moving away from a situation in which, as recently as 15 years ago, up to 90% of all waste was landfilled. This has been recently highlighted by the Environment Agency (EA) data released in November 2011 which shows total landfill inputs down by 45% over the last 10 years.

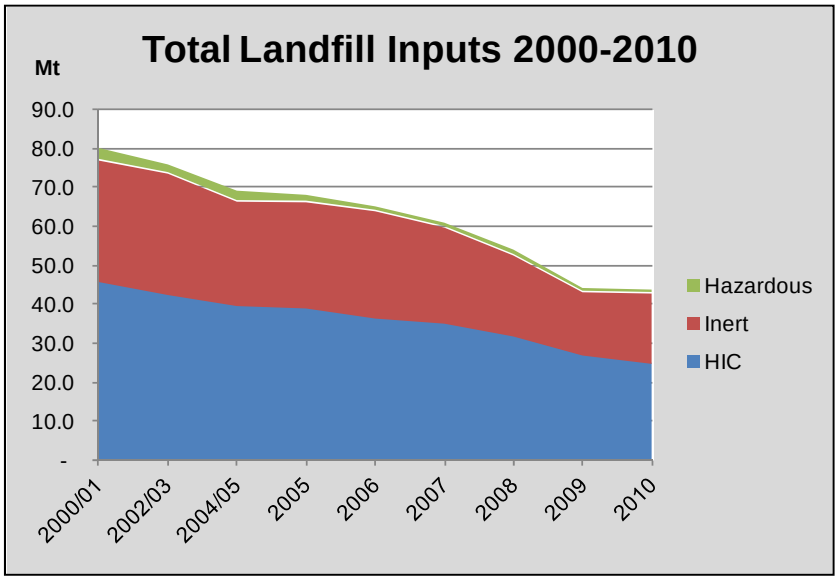


Figure 1: Total Landfill Inputs 2000-2010 - England Source:EA

Despite this decline, landfill still remains the predominant form of treatment/disposal for solid, non-hazardous, active combustible Residual Waste in England. In 2010 it is estimated that only 23% of these wastes were processed at Residual Waste Treatment Facilities (RWTFs).

Further advances in recycling and the increasing development of RWTFs such as Energy from Waste (EfWs) and Mechanical Biological Treatment (MBT) facilities will see landfill inputs decline further over the next 5-10 years.

And in June 2011, the Government, as part of the Waste Strategy Review, concluded that landfill bans and/or restrictions were back on the agenda:

> *"....even with existing measures in place and new actions which will drive waste up the hierarchy, it is likely that some waste will end up in landfill that could be put to better use and which may warrant the introduction of additional, legislative tools, such as landfill bans or restrictions, to ultimately achieve our aim."*

Given the continued pressures on landfill inputs it is little wonder that landfill operators face the future with some trepidation.

This Briefing Report, the third in a series of independent reports by Tolvik analysing the UK waste market, considers the factors influencing the future of the landfill market and, using recent European experience as a guide, provides insights into potential future landfill strategies, availability and gate fee pricing.

1.2. Scope

The focus of this Briefing Report is upon the English landfill market in the period to 2020, with a principal emphasis on:

- Municipal Waste – consistent with the wider definition wider European definition of *'waste from households, as well as other waste, which, because of its nature or composition, is similar to waste from households'* and as set out in Figure 2;
- Non-hazardous landfills and non-hazardous landfills with Stable Non Reactive Hazardous Waste (SNRHW) cells – which accept municipal waste but also other Household, Industrial and Commercial (HIC) wastes and inert wastes.

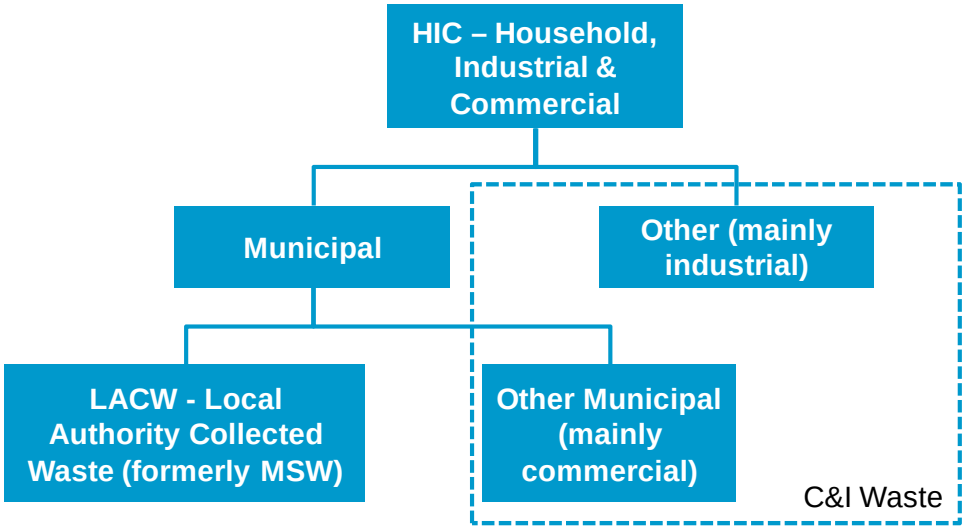


Figure 2: Waste Definitions used in the Report

Whilst many of the conclusions for England apply equally to the rest of the UK, the differing waste policies in the devolved regions (see Section 2.2) are likely to lead to some differences in the way in which the respective landfill markets develop.

1.3. Approach

Section 2 briefly considers the key policy and legislative drivers for the landfill market.

Section 3 provides the historic context for landfills in England and provides an overview of the market in 2010. **Section 4** uses this information to develop future volume projections for the market.

Section 5 looks at the lessons to be learned from selected European countries and **Section 6** provides an overview for the development of the market from an economic perspective.

Section 7 provides a brief insight into the diversification opportunities for landfill operators.

For consistency, when calculating future void availability, this report has applied the same density figures as used by the EA in its own analysis:

- 1.2 tonnes per cubic metre for non hazardous waste;
- 1.0 tonne per cubic metre for inert waste.

Where applicable, similarly, the EA assumption that inert imports to non-hazardous landfills for the purpose of engineering and cover will consume 25% of total void space has been applied.

1.4. About Tolvik

Tolvik Consulting is a specialist provider of independent, market analysis and commercial advisory services across the waste sector. Our clients include the UK's leading waste companies, project finance lenders, independent developers and equity finance providers. As a specialist consultancy, we have a unique understanding of the waste markets and monitor them closely, maintaining regular dialogue with the major players in the sector – from waste companies and local authorities, through to regulators, funders and policy makers.

2. LEGISLATIVE AND POLICY FRAMEWORK

This section provides a high level overview of the main legislative and policy drivers likely to influence the future commercial development of the landfill market.

A more detailed analysis of the legislative and policy framework for Residual Waste can be found in Tolvik's *2011 Briefing Report: Residual Waste in the UK* and is available for purchase at www.tolvik.com

2.1. Landfill Directive

The Landfill (Maximum Landfill Amount) Regulations 2011 came into force on 1 October 2011 and provide the revised Landfill Directive targets following the change in definition of municipal waste used in the UK from just the waste collected by or on behalf of local authorities to the wider European definition as set out in Section 1.2. The new regulations increase the maximum amount of biodegradable municipal waste (BMW) permitted to be landfilled in the UK for each of the "target years" – 2010, 2013 and 2020.

For reporting it is understood that Department for Environment Food and Rural Affairs (DEFRA) has agreed with the EU that municipal waste is defined under the following European Waste Codes:

- EWC Chapter 20;
- EWC Chapter 19 sub-section 12;
- EWC Chapter 15 sub-section 01.

Mt BMW *% of 1995 Inputs*	**2010** *75%*	**2013** *50%*	**2020** *35%*
England	21.8	14.5	10.2
Scotland	2.7	1,8	1.3
Wales	1.4	0.9	0.6
Northern Ireland	0.9	0.6	0.4
Revised UK	**26.8**	**17.8**	**12.5**
Original UK	*13.7*	*9.2*	*6.3*

Table 1: Revised Landfill Directive Targets Source: DEFRA

In September 2010 DEFRA reported provisionally that for 2009, using this revised definition of municipal waste, England had sent circa 14.6Mt of BMW to landfill against the 2010 target of 21.8Mt – i.e. **an undershoot of 7.2Mt.**

Mt	**All Household, Industrial, Commercial**	**Municipal Waste**	**BMW Content**[1]	**BMW**
LACW	12.8	12.8	68%	8.7
C&I Waste	14.2	8.8	68%	6.0
Total	27.0	21.6	68%	14.7

Table 2: 2009 England Landfilled Tonnages Source: Tolvik analysis of DEFRA/EA

Tolvik's own independent analysis of DEFRA and EA data differs by less than 0.1Mt and so confirms this analysis.

Using the 'old' definition of MSW and the 'old' Landfill Directive targets as defined by Landfill Allowance Trading Scheme (LATS), in the 2009/10 compliance year, **the undershoot in England was just over 2.7Mt[2].**

This highlights that by extending the definition of municipal waste, compliance with the Landfill Directive has actually been made easier.

2.2. Landfill Bans/Restrictions

Prior to the issue of the Government Review of Waste Policy in England 2011 (Waste Policy Review), the general consensus in England was that, following an earlier consultation by the previous government, the prospect of landfill bans/restrictions in England had significantly diminished.

However, the Waste Policy Review not only pointed to specific consideration being given to restrictions on Waste Wood to landfill, but suggested that wider landfill restrictions or total bans specifically for textiles and biodegradable waste could help the Government achieve its policy aims. The Review did however add the rider that *"the Government will need to be content (that) restrictions are the best value way of moving material up the waste hierarchy and that the costs to businesses and the public sector are affordable".*

Meanwhile both Scotland and Wales are progressing with landfill bans/restrictions which brings with it the prospect that these regions could become 'exporters' of small tonnages of waste to England.

More widely, the prospect of a complete EU ban on biodegradable waste to landfill by 2025 has emerged in the last 12 months – as part of a set of possible revisions to the Landfill Directive. Given that the UK was previously granted a four year derogation from the original legislation (i.e. the 2020 targets for the UK are 2016 targets elsewhere in Europe), it is reasonable to assume at this stage that such a derogation could also be applied to any future targets should the Government so wish.

2.3. Landfill Tax

Since Landfill Tax was introduced in 1997, it has become a very significant driver for the landfill market, and an increasing source of income to HM Treasury, with landfill tax receipts rising at a nominal CAGR of 9.3% p.a.

The April 2010 budget reconfirmed that the Landfill Tax payable for active wastes (i.e. including Residual LACW and C&I Waste) would continue to increase by £8/t from the then prevailing (i.e. 2010/11) level of £48/t to £80/t by 2014/15.

The result is that landfill will increasingly become the disposal point of last resort for most residual wastes, although there will always be some wastes for which landfill is the most appropriate option.

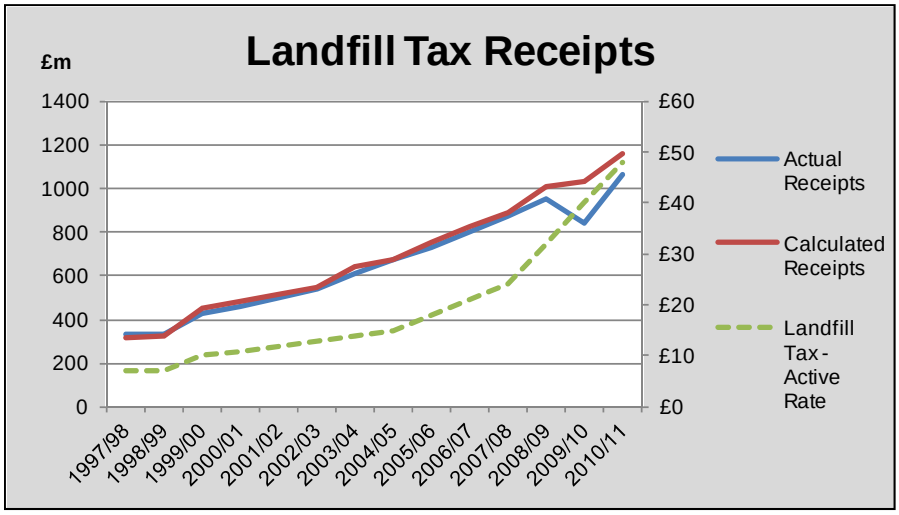


Figure 3: Landfill Tax Data Source: HMRC

As with most other forms of taxation, whilst there are currently no absolute legal obligations that Landfill Tax will remain in place, the June 2010 emergency Budget committed to providing a ten year floor to Landfill Tax to at least 2020 at a minimum £80/t. In Tolvik's opinion, given the success of the tax in diverting waste from landfill, it would not be unreasonable to assume that going forward Landfill Tax will at least rise in line with inflation.

However, once Landfill Tax reaches the current maximum and with further improvements in recycling and more RWTFs coming on stream, Landfill Tax revenues are expected to fall. In the current economic climate, the development of a policy tool alongside Landfill Tax may be very appealing to the Treasury. As noted in summer 2011[3] "*A single pricing instrument, such as the landfill tax, can achieve the optimal mix of waste management in a 'two treatment world', say landfill and recycling. Once we go beyond this world – to include energy recovery, recycling, re-use and waste prevention –* ***additional instruments are required*** *to ensure a cost effective waste management system*."

2.4. Landfill Economics

Article 10 of the Landfill Directive requires that:

"Member States shall take measures to ensure all of the costs involved in the setting up and operation of a landfill site, including as far as possible the cost of the financial security or its equivalent.. and the estimated costs of the closure and after-care of the site for a period of at least 30 years ***shall be covered by the price to be charged by the operator for the disposal of any type of waste in that site****."*

It has been suggested that Article 10 could be used to influence future landfill prices in providing some basis for a gate fee floor for operators. This has been the case recently in Ireland where the Environmental Protection Agency (EPA) is reported to be bringing action against landfills which are not charging a sufficiently high gate fee[4].

However, the EA has taken a light touch on the subject and its guidance states[5] that it "***is not required to interfere directly with the commercial decisions of individual companies*** *in applying the Article 10 provision. Operators of landfills are private sector companies who are performing this role for profit and are required separately to ensure that financial provision is in place to deal with the costs of closure and aftercare. It follows that the relevant costs will be met by the prices charged, including inhouse sites where no specific charge for waste is made."*

2.5. Planning and Permitting

In the light of declining waste volumes to landfill, it is no surprise that limited new landfill capacity is being planned. Earlier in 2011 it was reported[6] that over the UK during the previous year just 1 Mm^3 of additional void was consented whilst over the same period, applications for an additional 13 Mm^3 were either withdrawn or refused.

As DAC Beechcroft have identified, there are a number of planning implications to consider if market conditions are such that operators are forced to consider either extending the time limit for landfill closure with a reduced rate of fill (which is increasingly common), mothballing a site for later operations or even the absolute closure of a landfill site prior to completion.

Of critical importance is the evolving planning landscape following the introduction of the Localism Act 2011, the draft National Planning Policy Framework (NPPF) and the diminishing weight to be attached to Regional Strategies.

Whilst national, regional, and local waste policies will clearly inform a decision on planning, waste operators should be conscious of the scope for neighbourhood planning in the Localism Act to play a role in future decision making. In particular, in the absence of a waste local plan, a neighbourhood plan, with the support of more than 50% of the residents, could potentially reduce an operator's scope for considering both future operations or future uses at landfills.

The recently published draft NPPF, whilst expressly isolating waste policies, may assist operators in terms of considering the scope for mothballing, closing or limiting rates of infilling for landfill sites. For instance, there are references to local planning authorities ensuring the viability and deliverability of projects. In respect of housing delivery, the NPPF defines when a site is viable as being when *"it would provide acceptable returns to a willing landowner and a willing developer based on current values and taking account of all likely infrastructure standards and other costs"*. Perhaps this is something that could be used in negotiations with a planning authority to determine the future of any landfill site.

In terms of extending time limits for landfill sites, this ideally should be approached prior to operations being reduced or ceasing on the site, but in general the changing market conditions provides good and valid arguments for extending time limits with perhaps modified aftercare conditions. However, where a site has been mothballed and there is then an extension of time application, the difficulties are likely to be much greater. There have been cases where landfill cells are completed and capped, and a site has then been mothballed with ongoing monitoring. A few years later an application is then made for an extension of time, as a result of perhaps the closure of other sites, changes in the waste streams and viability issues. Pure technical and planning policy arguments would normally support such an application, particularly if there is less than a 10 year provision. However, considerable opposition from local residents often results where a site has been mothballed for a few years and residents have 'benefitted' from the cessation of operations.

As is often the case, planning obligations usually also apply to landfill sites. Therefore an application to modify a planning obligation will be required where changes have been made to the underlying consent.

If a site is to be closed permanently prior to completion, an application to vary conditions would need to be made, so that the after care arrangements are modified, ongoing monitoring is altered and arrangements made for the remaining void within a landfill site to be reused for another purpose or closed for further amenities.

Whether a site is closed permanently or mothballed early discussions with the EA will also be required. For permanent closure, assuming planning consent is granted, the closure of the landfill will need to be formalised and the site move on to the aftercare phase. Aftercare and monitoring conditions of up to 60 years are not uncommon and it is unlikely therefore that an immediate surrender of a permit will be accepted by the EA.

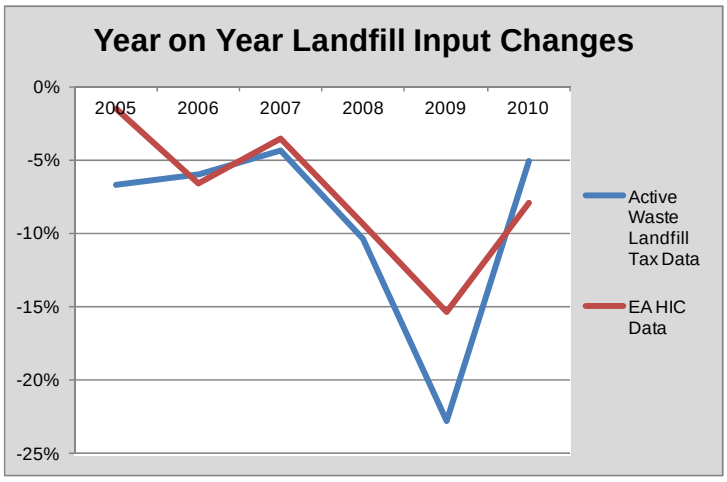
If it is considered that a site is to be mothballed but with the possibility of reopening in the future, careful consideration will need to be given to how the site should be capped and monitored in the interim. Whether closing permanently or temporarily, financial guarantees will need to remain in place to ensure that sufficient funds are available to meet the obligations of the permit until such time as the EA will accept its surrender, including throughout the closure and aftercare phase.

3. LANDFILL – A BRIEF HISTORY

3.1. Landfill Inputs

Figure 1 highlighted the extent of the decline in tonnages to landfill in England over the last 10 years – with total volumes down 45%. More recently, the last 4 years has seen significant year-on-year reductions in inputs – in 2008 tonnages were down 10%, at the height of the recession in 2009 tonnages were down circa 20% and in 2010 down circa 5-8%.

Provisional HMRC figures for the first 9 months of 2011 suggest a further 17% fall in active waste tonnages to landfill over the same period in the previous year.



Mt	HMRC - UK		EA - England	
2004	46.8		39.7	
2005	43.6	**-7%**	39.1	**-2%**
2006	41.0	**-6%**	36.5	**-7%**
2007	39.2	**-4%**	35.2	**-4%**
2008	35.2	**-10%**	31.9	**-9%**
2009	27.2	**-23%**	27.0	**-15%**
2010	25.8	**-5%**	24.9	**-8%**

Figure 4: Year on Year Changes in Landfill Inputs Source: EA/HMRC

3.2. Overall Landfill Void

Until recently the landfill market bore an uncanny resemblance to the oil industry with a fear that the capacity would soon run out and that something had to be done urgently.

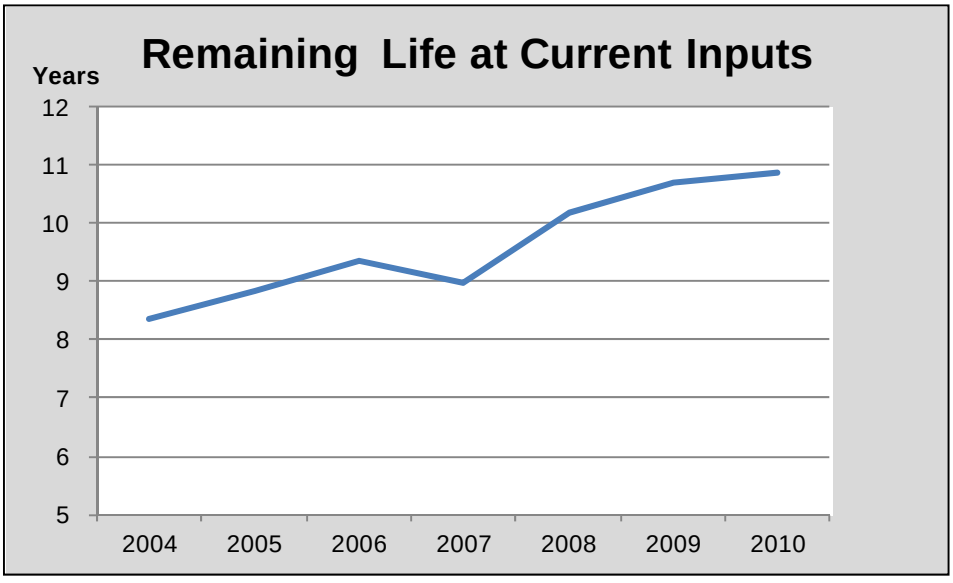


Figure 5: Remaining Life at non-inert Landfills Source:EA

In 2007, the EA reported[7] that at the then prevailing rate of inputs, there was sufficient capacity at

non-hazardous landfills to last a further 6.5 years. A year later the figure had risen to 8 years and, since then, the EA has not publicised its calculations (although its own figure for 2010 remains at around 8 years).

As shown in Figure 5, Tolvik's own calculations estimate that there has been a steady increase over the last 6 years in the remaining life at non-hazardous landfills - with the current total of 446Mm^3 representing the equivalent of just under 11 years of void. At a national level, therefore, the spectre of 'running out of landfill' has long since passed.

3.3. Landfill Numbers and Geographical Distribution/Regional Variation

In 2009 there were 160 merchant Non Hazardous or Non-hazardous landfills with SNRHW which accepted in excess of 25ktpa in the year. Collectively these sites accounted for over 98% of total Household, Industrial and Commercial (HIC) inputs to landfill.

At a regional level, this landfill void is reasonably evenly distributed across England. Much has been made in the past about the lack of landfill capacity in London and South East; but as a result of extensions and slowing inputs, at 2010 rates of input the average void lives for these regions were 6 years and just under 8 years respectively. Of the other regions, the South West was the only other area with less than 8 years of void remaining.

However, at a sub-regional level, there are undeniably areas in which remaining void is low. Figure 6 serves to highlight the shortfall in void in much of London and along the south coast but also the differences within a region – where Buckinghamshire has significant long term void. A similar figure indicating the actual void capacity at a sub-regional basis can be found in Appendix 2.

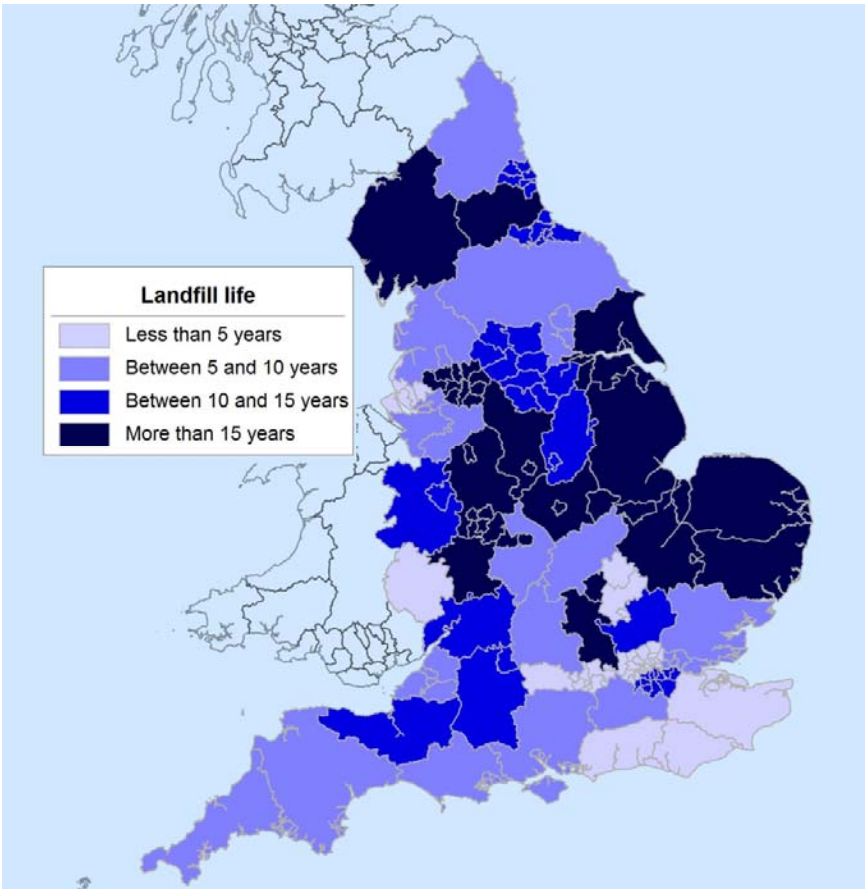


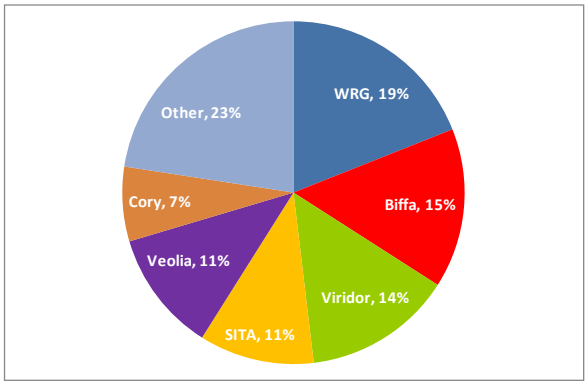
Figure 6: Sub-Regional Remaining Void Capacity Source:EA

3.4. Landfill Operators and Market Shares

In England the non-hazardous landfill market is dominated by 6 players who collectively control 75% of the market; after sixth ranked Cory Environmental the next largest operator has below 2% market share.

In general the remaining void at current inputs for these large operators are in line with the national average at around the 9-10 years; for Cory it is a little lower (distorted by Mucking landfill which closed in 2010), whilst for WRG the figure is above 15 years – although this includes some landfills which are understood to have been mothballed by WRG.

Market Share by 2009 Inputs – Source: EA



Market Share by Void – Source: BDS

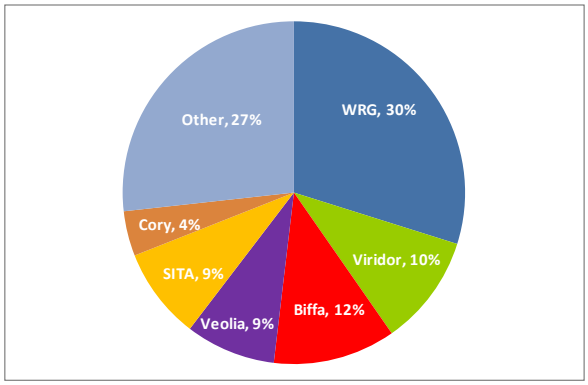


Figure 7: Market Shares of leading operators

There is a mixed picture when it comes to regional distribution of this landfill capacity with Veolia strongest in London and East (largely Essex); WRG in South East (particularly Oxfordshire /Buckinghamshire), North West and East Midlands and Biffa in Yorkshire/Humberside and West Midlands. Viridor are strongest in the South West and SITA in the North East.

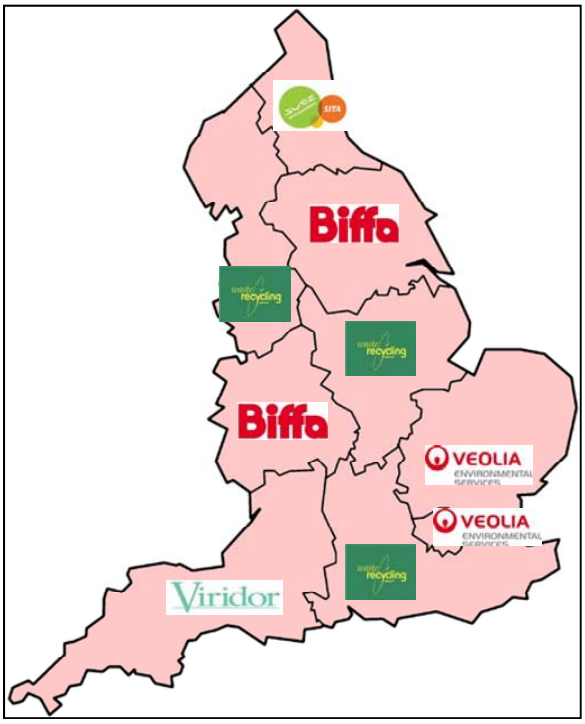


Figure 8: Leading Regional Landfill Operators – 2009 Inputs

4. PROJECTIONS

4.1. Residual Municipal Waste

This report applies a similar methodology to projecting Residual Waste tonnages as that used in Tolvik's *2011 Briefing Report: Residual Waste in the UK*[8] but applied only to England.

In the **Central Case** for LACW it is assumed that England achieves the 50% revised Waste Framework Directive recycling target by 2020. Prior to 2013 LACW arisings have been modelled to continue to fall but thereafter arisings are projected to increase at 0.5% pa – broadly equivalent to 50% of the Office for National Statistics (ONS) projection for the rate of growth in household numbers.

The municipal element of the C&I Waste stream ("Other Municipal") has been estimated using the analysis contained in the DEFRA C&I Report[9], with all Commercial waste and the Mixed Ordinary Waste and Non-Metallic Wastes from the industrial waste arisings stream conservatively being regarded as municipal waste.

The portion of this C&I Waste stream which in 2009 was Residual Waste (at just under 32%) has been calculated using the information in the DEFRA C&I Report.

Mt		**2009**	**2010**	**Tolvik**	**DEFRA**	**Diff**
				2020		
Arisings	LACW	26.8	25.9	26.2	25.6	0.6
	Other Municipal	29.6	29.8	31.3	26.0	5.3
	Total	**56.4**	**55.7**	**57.5**	**51.6**	**5.9**
Residual	LACW	16.4	15.4	13.1	12.8	0.3
	Other Municipal	9.4	8.9	6.3	10.4	(4.1)
	Total	**25.8**	**24.3**	**19.3**	**23.2**	**(3.9)**

Table 3: Municipal Waste Projections

Table 3 compares Tolvik's Central Case municipal waste projections with those produced in DEFRA's PFI Change Analysis used to support the decision to withdraw funding from 7 PFI projects in 2010[10]. The DEFRA document has broadly similar projections for LACW, but for Other Municipal wastes, whilst Tolvik's estimates of arisings are significantly higher, the estimated Residual Rate at 20% is half that assumed by DEFRA (at 40%).

There is a material difference in methodology between the two approaches; Tolvik's estimates include significant volumes of Non-Metallic Wastes (which are largely segregated recyclables) – this serves to both increase estimated arisings but also recycling rates.

Of course, not all the identified Residual Municipal Waste will be sent direct to landfill – some will be treated at RWTFs.

4.2. 2009 RWTF Capacity and BMW to Landfill

Tolvik's *2010 Briefing Report: Residual Waste in England and Wales*[11], identified circa 6.3Mt of RWTF Capacity available in 2009, of which 6.2Mt was located in England. With an available capacity of 85%, this is the equivalent to 5.3Mt of Residual Waste processed in 2009.

The report focussed on a wider definition of waste than municipal waste and it is estimated that circa 0.4Mt of capacity was used for the treatment of Residual Waste which was not municipal waste. It has also been assumed that on average 15% of inputs to RWTFs (principally the non recyclable outputs from MBT/MHT facilities) was landfilled and contained BMW.

2009	Mt
Headline RWTF Capacity	6.2
Available RWTF Capacity (85%)	5.3
Used for non municipal waste	(0.4)
Municipal Waste Inputs	4.9
Outputs to Landfill (15%)	(0.7)
Municipal Waste diverted from landfill	**4.2**

Table 4: RWTF Diversion of Municipal Waste in England 2009

Table 5 cross refers this analysis with the actual landfill data in Section 2.1 and so serves to validate the methodology applied in this report.

2009	Mt
Total Residual Municipal *(Table 3)*	25.8
Municipal Waste diverted from landfill *(Table 4)*	4.2
Residual Municipal to Landfill *(as per Table 2)*	21.6

Table 5: Municipal Waste Reconciliation 2009

4.3. Projected BMW to Landfill – 2009 RWTF Capacity

Analysis of the effect of the unrealistic scenario that saw no further RWTF capacity developed over and above the 4.2Mt operational in 2009, would suggest rather surprisingly, that if the projected Central Case improvements in recycling were achieved, and assuming the BMW content of landfilled Residual Waste remains at 68% (as used in the PFI Change Analysis) **then the Landfill Directive targets could just be met in 2020 without the need for any new RWTF capacity to be constructed.**

Mt	2009	2010	Tolvik	DEFRA	Diff
			2020		
Total Residual Municipal Waste *(Table 3)*	25.8	24.3	19.3	23.2	(3.9)
Municipal Waste diverted from landfill	4.2				
Residual Municipal to Landfill	21.6	20.1	15.1	19.0	(3.9)
BMW To Landfill	**14.6**	**13.6**	**10.2**	**12.9**	**(2.7)**
Landfill Directive Target *(Table 1)*	-	21.8	10.2		
Variance to target	-	8.2	-	(2.7)	(2.7)

Table 6: Compliance with Landfill Directive – No New RWTFs

A recent survey[12] of leading professionals across the waste sector suggested that 53% of respondents felt that the 50% household waste recycling rate was most likely of all the targets to be met.

However, as noted in Tolvik's 2011 Residual Waste UK Briefing Report, the rate of increase in LACW recycling rates has slowed down, and if the rate of decline trend over the last 3 years were to continue then the LACW recycling rate for England as a whole by 2020 is projected to be just over 44%.

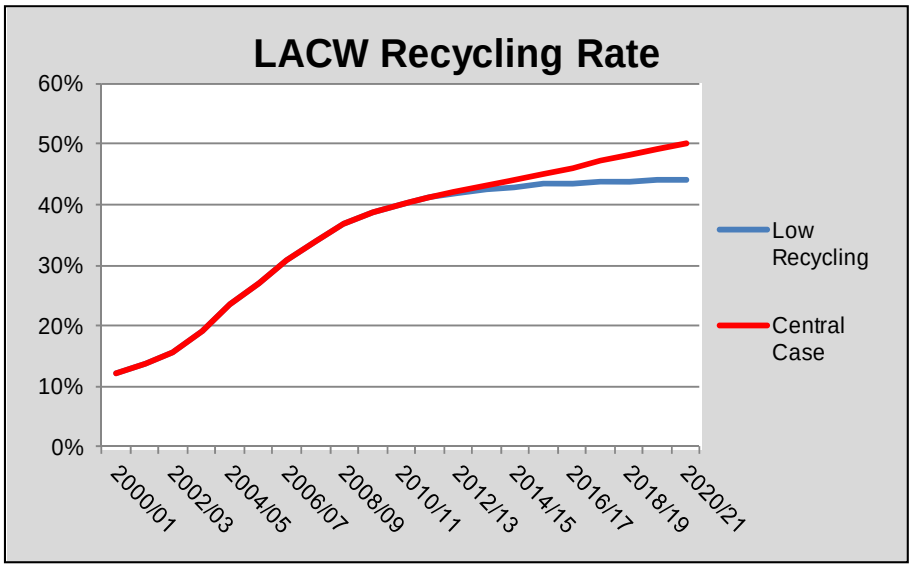


Figure 9: LACW Recycling Rates

If a similarly more modest assumption regarding the improvement in recycling of Other Municipal Waste is made, then in this "Low Recycling" Scenario total Residual Municipal Waste is 23.2Mt – notably an identical total to DEFRA's estimate.

Mt		Tolvik Central Case	Tolvik Low Recycling	DEFRA
		2020		
Residual	LACW	13.1	14.6	12.8
	Other Municipal	6.3	8.6	10.4
	Total	**19.3**	**23.2**	**23.2**

Table 7: Comparison of Scenarios

In this Low Recycling Case, as per DEFRA's projection in Table 6, an additional 2.7Mt of BMW (4.0Mt of Municipal Waste) would need to be diverted by new RWTFs if the Landfill Directive target were to be met.

4.4. Future RWTF Capacity

As identified in Tolvik's 2011 Residual Waste UK Briefing Report, the real constraint to RWTF development is increasingly one of financial and construction capacity, rather than planning. At the time of writing the report in summer 2011, across the UK as a whole, 2.2Mt of RWTF capacity was identified as under construction (excluding, to prevent double counting, specialist RDF/SRF facilities).

Subsequent information suggests that this figure was over-stated by 0.3Mtpa. If RWTF construction were to be continued at this level consistently through to 2020 (an equivalent, based on an average three years construction programme of an annual run rate of 550ktpa of additional RWTF capacity), this would result in a total of 12.1Mt of RWTF capacity in England by 2020. This is the equivalent to

an overall 'probability of development' for the identified planned projects in Tolvik's 2011 Residual Waste UK Reportof a reasonably modest circa 33%.

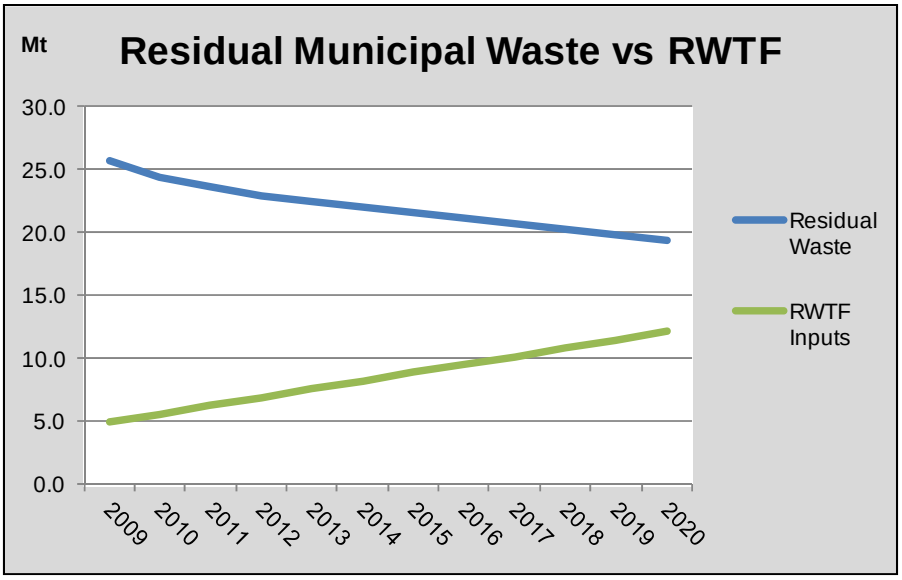


Figure 10: Residual Municipal Waste vs RWTF Inputs – Central Case

The **Central Case** therefore assumes a run rate of 550ktpa of additional RWTF capacity. This figure excludes dedicated RDF/SRF thermal treatment facilities and, for simplicity, it is assumed that the BMW outputs from RWTFs sent to landfill decline to zero over time as such RDF/SRF facilities are constructed. In practice there will always be a reject stream which has to be landfilled but in reality this is likely to be very low in BMW content.

Given the relative immaturity of the export markets (see Tolvik's *2011 Briefing Report: Opportunity or Threat?*) it has been assumed for simplicity in this report that by 2020 there will be nil exports of RDF/SRF from the UK. That is not to say however that there will not be exports of treated Municipal Waste in the period through to 2020.

4.5. Meeting the Landfill Directive

The effect of these Central Case assumptions is that in the Central Case **England comfortably achieves its Landfill Directive targets.**

Even using Tolvik Low Recycling/DEFRA projections of waste volumes the target is met with 0.8Mt of BMW of 'headroom'.

Mt	2009	2010	Tolvik Central Case	Tolvik Low Recycling	Diff
			2020		
BMW To Landfill *(Table 6)*	**14.6**	**13.6**	**10.2**	**12.9**	**(2.7)**
Additional BMW Diversion – New RWTFs	-	0.2	3.5	3.5	-
BMW To Landfill	14.6	13.4	6.7	9.4	(2.7)
Landfill Directive Target	-	21.8	10.2		
Variance to target	-	8.4	3.5	0.8	(2.7)

Table 8: Compliance with Landfill Directive

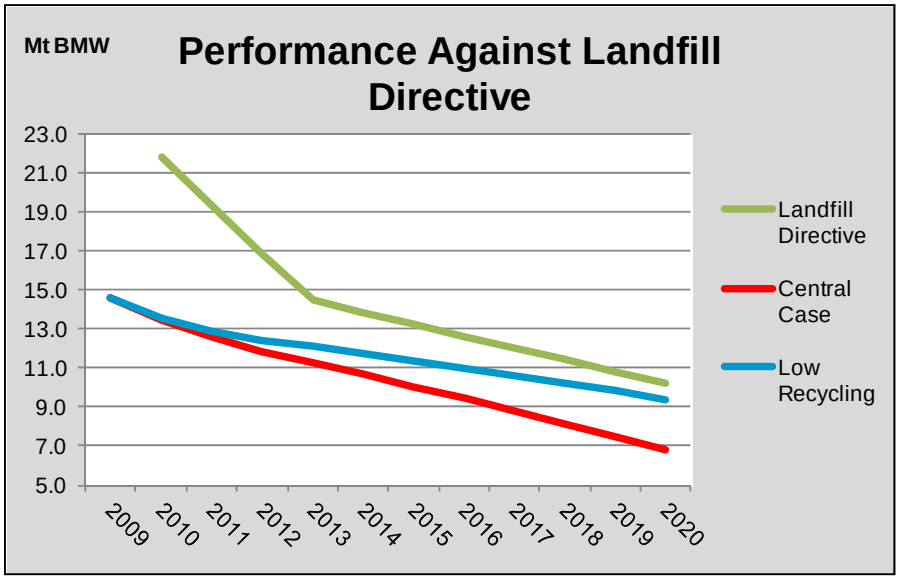


Figure 11: England Performance Against Landfill Directive – Central Case

With a similar assumption regarding RWTF development as the Central Case, so **the Landfill Directive targets are also met in the Low Recycling scenario**.

4.6. Variations in the Rate of RWTF Development

However, the rate of this development of new RWTF capacity is a key sensitivity.

It is worth noting that the Landfill Directive targets could also be met in the Low Recycling Scenario if the annual run rate for new RWTF capacity is 375ktpa – the "**Do Minimum**" Scenario. This is the equivalent of 3 'standard' 250ktpa EfWs being developed every three years.

At the other end of the spectrum, Tolvik's 2011 Residual Waste UK Report provided a high level probability analysis of future RWTF capacity on the basis that eventually (but not necessarily by 2020), all LACW-backed RWTF capacity would be built and that 33.5% of merchant RWTF capacity would be built. For the UK this suggested 19.6Mt of RWTF capacity, of which England's share would be 15.7Mt.

To achieve these figures by 2020 would require an annual construction run rate of 840ktpa (or based on average 3 years construction programme 2.5Mt of RWTF in England under construction at any one time) and, combined with the Central Case recycling assumptions, represents the **"High RWTF"** Scenario.

4.7. Implications for Landfills

HIC inputs to landfills (including municipal waste but also other active wastes but excluding inerts) are, inevitably, going to continue to fall over the next 10 years.

Modelling the four scenarios – Central Case, Low Recycling, Do Minimum and High RWTF, HIC inputs to landfills are projected to fall by between 20-55% when compared with 2010; with the **Central Case showing an almost identical rate of decline to that seen over the past 10 years.**

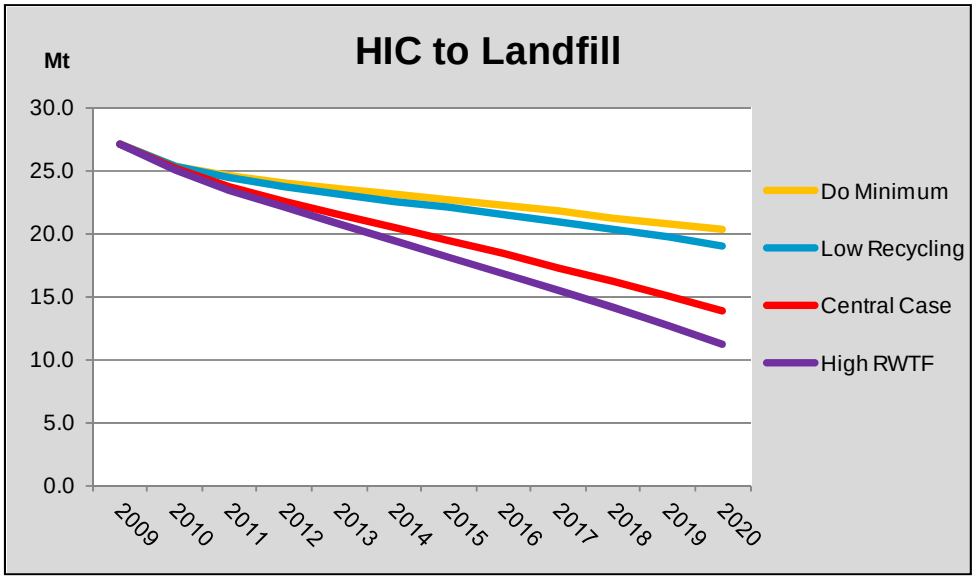


Figure 12: HIC Waste to Landfill

Modelling the implications of these projections on landfill void, **by 2020** in the Central Case it is estimated that without any further additions in void capacity, **there would still be 7 years of void remaining** and in the High RWTF there would be 10 years.

In the Low Recycling Scenario the figure is much lower at 4 years, and in the Do Minimum Scenario it is projected to be 3 years.

5. EUROPEAN EXPERIENCE

5.1. Comparison of England with Europe

	Estimated Inputs Mt				# of Landfills	(Million)	Total Inputs/ Capita
	House-hold	Other Active	Inert	Total Inputs		2009 Popn	
England	12.8	14.8	16.3	43.9	416	52.2	0.84
Netherlands	-	0.7	1.6	2.3	22	16.7	0.14
Sweden	0.1	1.0	2.7	3.8	157	9.4	0.40
Germany	0.2	14.9	20.3	35.4	1,553	81.7	0.43

Table 9: 2009 Landfill Data

Table 9 provides a high level overview of landfill operations in England, Netherlands, Sweden and Germany, excluding mining wastes but including inert only landfills.

Direct comparisons between countries need to be treated with caution given the varying definitions, but the relative reliance in England on landfill is clear – particularly for 'household' waste – as is the low inert figure for the Netherlands and Sweden – where reported inputs are significantly below those seen in other countries.

5.2. Netherlands

Figure 13 charts the decline in landfill inputs and landfill numbers in the Netherlands over the last two decades (using 1992 as the index date). The figure highlights the extent to which the average inputs per landfill have remained broadly level – with the number of active landfill sites reducing in line with inputs.

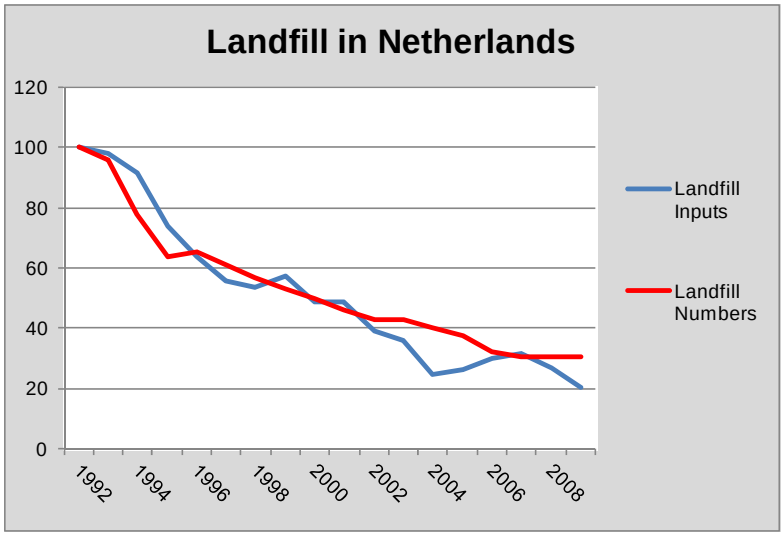


Figure 13: Index of Landfill Inputs and Active Waste Sites Source: CBS

With an 80% decline in inputs over the period – due in large part to the introduction of a landfill tax for combustible waste – currently at €107/t, together with restrictions on the landfilling of 35 categories of combustible waste – the economic position for Dutch landfill operators is reported to be 'challenging'.

However, it is generally recognised in the Netherlands that landfills have a role to play as reserve

waste disposal capacity for waste which cannot be otherwise recovered and the key issue the landfill industry is facing, with gate fees reported to be €20-€30/t[13], is to ensure that landfill operations are sufficiently profitable so as to be economically sustainable.

5.3. Sweden

Sweden has landfill bans on combustible waste and organic waste and a landfill tax of approximately €45/t.

The historic pattern of inputs and landfill numbers in Sweden is similar to that for Netherlands (with an 1997 index date) – as volume of waste to landfill declines, so the number of active landfills has correspondingly reduced, resulting in broadly similar volume of waste inputs into each landfill.

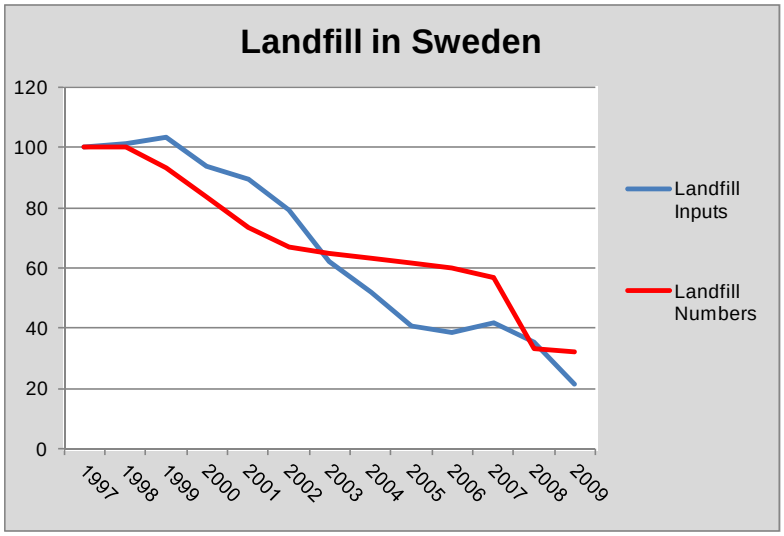


Figure 14: Index of Landfill Inputs and Non-Hazardous Landfills Source: Afval Sverige

Regarding current gate fees for household waste (the very small share that is still landfilled), Afval Sverige states that the average value was €39/t, with gate fees before tax ranging from €12/t-€77/t.

5.4. Germany

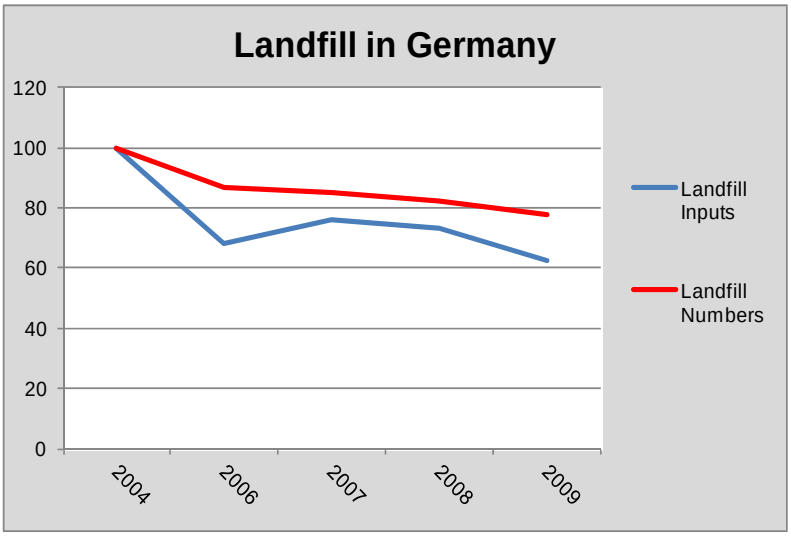


Figure 15: Index of Landfill Inputs and landfill numbers Source: Statistisches Bundesamt

The German landfill experience has been heavily influenced by the introduction of a landfill ban which took effect in 2005 which significantly limited the tonnages of waste permitted to be landfilled.

Figure 15 shows a shorter time series than for Netherlands and Sweden and whilst the graph clearly shows the dip in landfill inputs in 2005 following the introduction of the landfill ban it is more difficult to draw firm conclusions with respect to long term trends. Total volumes of wastes to landfill were reported to be at an all time low in 2009, but this was as much due to the effects of the recession as any wider waste developments.

5.5. Summary

Whilst care is needed in drawing too many conclusions from other European markets when considering the English landfill market, the anecdotal evidence would seem to suggest that in the face of declining demand for landfill:

- The number of active landfill sites follows the declines in inputs;
- There is a 'floor' to landfill gate fees as is required to make a landfill commercially viable.

6. ECONOMICS

6.1. Historic and Current Gate Fees

The historic landfill gate fees in England as reported by WRAP[14] and by Pennon Group plc, the parent company of Viridor, are set out in Table 10.

£/tonne	Median	Low	High	Viridor
2008	£21	£11	£40	£19.30
2009	£22	£8	£42	£21.48
2010	£23	£11	£51	£22.00
2011	£20	£12	£36	£22.15

Table 10: Landfill Gate Fees - England Source: WRAP/Pennon

The WRAP figures are based on LACW gate fees (typically on longer term contracts) and so do not include Residual C&I Waste. Additional information which Tolvik has received under confidentiality confirms an average gate fee of £20-£21/t across England.

However, there is a significant variance in landfill prices from region to region, site to site and indeed customer to customer, with Tolvik aware of recent spot prices in one market as low as £6.50/t. There are a number of factors which influence gate fees – including competitive pressures, suitability of wastes, volumes, client identity (and location) and site operating costs.

6.2. Landfill Gas Revenue

Electricity revenue from landfill gas is currently a significant source of income for those landfill operators which have retained control over their landfill gas assets. In 2010, with an estimated average price of circa £80/MWh, nationally landfill gas income is worth nearly 40% of total landfill income.

		Volume	Price	Revenue £m
UK	Landfill Gas	5.04[15] GWh	£80/ MWh	404
England	HIC	24.9 Mt	£21/ tonne	522
	Inerts	18.1 Mt	£2/ tonne	36
	Hazardous	0.6 Mt	£50/ tonne[16]	31
	Gate Fee Income	43.6 Mt		589

Table 11: Landfill Revenue Source: Tolvik Analysis

Over the last 5 years, for landfill operators who retain their landfill gas assets, rising landfill gas energy production and electricity prices have helped at a corporate level to net off the cash flow effects of the ongoing downward pressure on landfill volumes.

There is, however, a general consensus that electricity production from landfill gas has just about peaked and in the future reasonably steep reductions in landfill gas revenues can be expected as shown by Figure 16 released with the Renewable Obligation Certificates (ROCs) banding consultation[17]. The drop in electricity production from landfill gas in the medium scenario between 2010 and 2020 is projected to be 56%; the average of a wider range of reports suggest a figure nearer to 40%.

Whilst most observers predict strong upward movements in wholesale power prices over the next 10 years, wholesale power prices are just a component of the electricity income for landfill gas operators, alongside ROCs and Non Fossil Fuel Obligation (NFFO) arrangements which will rise more slowly, and given the scale of the expected drop in landfill gas volumes, **it seems likely that gross revenues from landfill gas will inevitably fall steadily in time**.

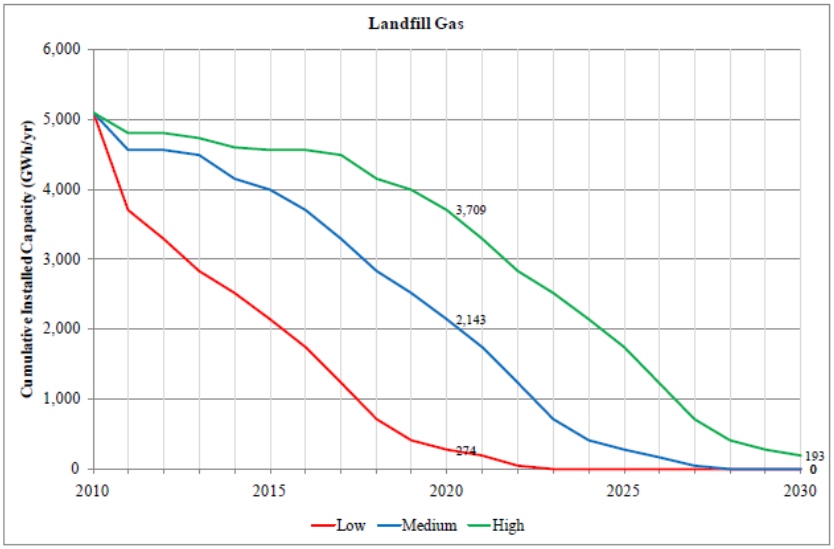


Figure 16: UK Landfill Gas annual electricity generation Source: DECC/Arup

Scope for the development of new landfill gas assets is limited and this is reflected in the ROC banding consultation which proposes the removal of ROC benefit from future landfill gas schemes. Older installations benefit from 'grandfathering' of their ROC arrangements.

However, the relatively weak relationship 'in year' between landfill inputs and electricity income from landfill gas (and the fact that for a number of landfill sites, landfill gas is operated by an independent third party), means that **landfill gas revenues are generally unlikely to materially influence the future direction of landfill gate fees.**

6.3. Future Landfill Economics

That there will be pressure on future landfill volumes can be of little doubt, and implicit in the analysis in Section 4 is that landfill tax will be sufficiently high that for 'suitable' Residual Waste, landfill is likely to become the disposal route of last resort.

In general terms therefore, landfill pricing will not be set by competitor RWTF prices but by the economics of landfill and landfill-to-landfill competition.

In such circumstances, it would not be unreasonable to assume that there will be downward pressure on gate fees as **operators look to reduce prices in an attempt to maintain volumes** and/or achieve planning end dates. This might be expected to be particularly so for long life landfill voids where the projected life is such that low gate fees offer 'time value' benefits over preserving void for a number of years in the future.

However – is this a likely scenario?

If gate fees were to fall, then it is reasonable to assume that the floor price for gate fees will be driven by marginal economics which in turn will be a function of a combination of factors including:

- Annual input tonnages – the larger the annual input, generally the lower per tonne marginal cost as a significant portion of landfill costs are fixed. Tolvik's analysis shows that for the major landfill operators, in 2009 only 20% of landfills accepted less than 50ktpa of inputs and after adjusting for those which are now closed, this figure fell to nearer 10%;
- Share of income arising from higher gate fee contracted volumes – which make a greater contribution to the fixed cost base;
- Engineering complexity – sites which are 'landraising' over existing waste and/or existing voids have significantly lower engineering costs per tonne of waste accepted;
- Royalty payments – often due where the operator is not the freeholder of the land.

Analysis of the company accounts for a number of the leading waste companies suggests an average EBITDAP margin for landfill operations of circa 30-35%; i.e. that the full cash operating cost for a landfill site is around £13.00-£15.00/t of active waste inputs and that the marginal cost (including both variable and semi-variable costs) is likely to be nearer £10.00/t.

Tolvik has developed a simple pro-forma financial model for a **generic landfill** which accepted 175ktpa of inputs in 2010 (the average for England). Two scenarios have then been developed based on the Central Scenario:

- Gate Fees remain at current levels;
- C&I Waste Gate Fees fall by 2013 to a marginal cost of £9.75/t.

Further details on these assumptions can be found in Appendix 1.

The effects of these trends are shown in Figure 17. In the marginal gate fee scenario maintaining positive cash flow post 2013 will be challenging unless input tonnages are boosted by the diversion of waste from proximate landfills which have closed.

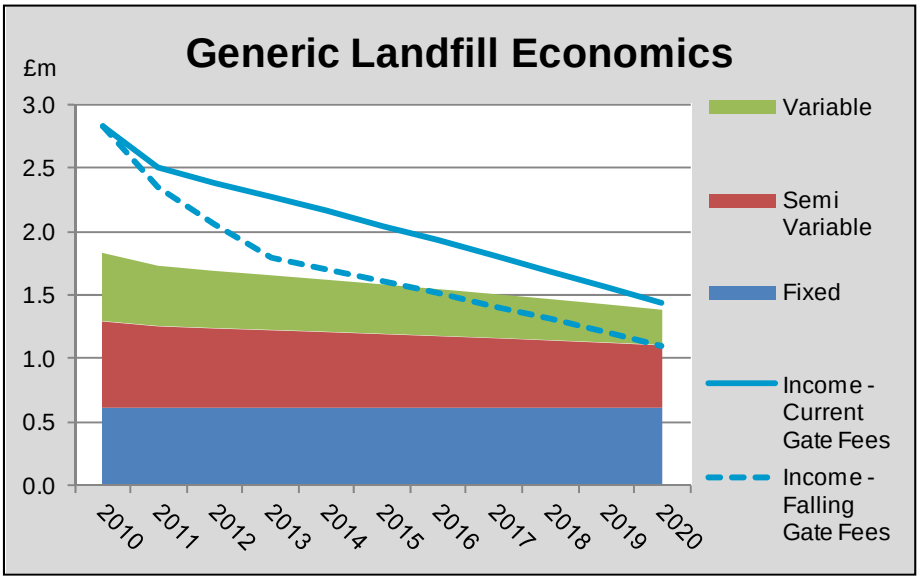


Figure 17: Generic Landfill Economics Source: Tolvik Analysis

It should be noted that this analysis is appropriate for a generic landfill site the actual effects will vary from site to site - and indeed for some sites it may be possible that the generic model is not appropriate.

However **for a substantial number of landfill sites, the analysis confirms that reducing C&I Waste gate fees to a marginal level will not be sustainable and a number, even at current gate fees, are likely to soon become uneconomic.**

For many already struggling sites, a 'trigger point' will be reached in the next few years which will force a decision on the future of the landfill. Two common examples would be the need to invest in significant capital expenditure for additional cell engineering or the loss of a major long term LACW contract (e.g. where Residual Waste has been diverted to a new RWTF). In such circumstances the extant economic model for the landfill will no longer be viable.

The landfill operator is then faced with four options:

- **Increase gate fees** to the point at which economic viability can be achieved – this is unlikely to be viable until/if there is a wider structural change in the market;
- **To continue to operate at a loss** either in the hope that the local market will subsequently improve following the closure of a proximate competitor or where a site is an essential part of a wider integrated service offering and needs to operate;
- **To seek to maximise waste inputs to allow for a rapid closure of the site** (which may also include diverting tonnages from the operators' other landfills) – particularly pertinent where a landfill is near to its planned end date;
- **'Mothballing' the site at the earliest opportunity –** and wait until other sites in the area close and market conditions improve.

There are already some signs that some of the larger operators are starting to actively manage their landfill portfolio and it is likely that this trend will develop further. Smaller operators are more limited in the options available to them and there are already examples of early, unplanned mothballing of sites which are yet to achieve planning contours but for which future reactivation looks a very unlikely prospect. The expectation of active management of void would appear to be supported by the experience in Europe.

Assuming such logic in England, Tolvik has analysed void on a site by site basis and compared it with 2009 waste inputs; by reallocating inputs from sites which close, it is possible to estimate future landfill numbers suggesting that by 2020 circa 55 landfills will remain in operation in England – broadly equivalent to just one site in each county.

6.4. Gate Fee Projections

In the light of this analysis, **in Tolvik's opinion adjustments to landfill supply side are a more likely long term consequence of the declining tonnages than a sustained move to lower gate fees.**

In the short term, the effects of void adjustments are likely to be limited and gate fees are expected to continue to come under pressure; but as additional RWTFs become operational, and landfills encounter more 'trigger points', so Tolvik would expect to see void corrections increase and gate fees recover to at or near current levels.

In the longer term, for that Residual Waste for which landfill remains a commercially or practically viable option – either because it is not suitable for treatment in an RWTF or where there is a shortfall in RWTF capacity, direct localised competition between landfills will diminish as the number of landfills decline.

This may provide the opportunity for landfill operators to increase prices to reflect the transport benefits arising for exclusive proximity within their local catchment area. With 55 such sites in

England, then these benefits are likely to typically materialise within a 20-30 mile radius – and so potentially worth £5-£10/t – but these gate fees will be capped by what is necessary to achieve an acceptable margin; should margins rise too high then the rate at which landfills close will reduce.

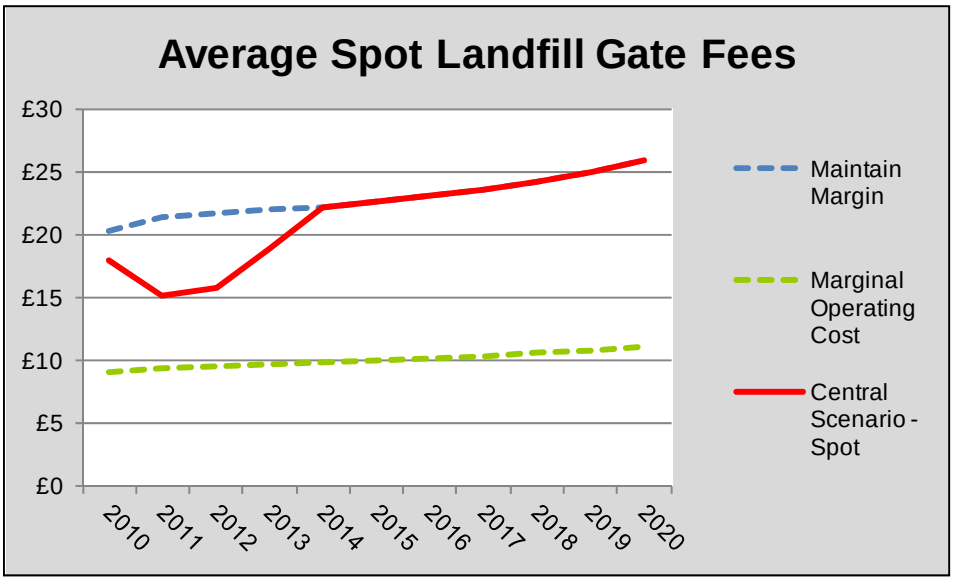


Figure 18: Projected Spot Landfill Gate Fees Source: Tolvik Analysis

7. DIVERSIFICATION OPPORTUNITIES

This section briefly considers the various diversification opportunities being considered by landfill operators for sites for which there are no material post completion planning obligations – e.g. to set up a country park or to provide wide ranging public access - which could restrict development opportunities.

These fall into four main categories – further waste management, energy, agriculture and leisure.

7.1. Waste Management

With a history of existing waste use, former landfill sites are regularly identified in local waste development plans as potential locations for future waste management facilities – from large scale EfWs through to Household Waste Recycling Centres (HWRCs) serving the local community.

Conceding existing landfill void as part of a planning gain within a planning application is not uncommon (e.g. Viridor Ardley); whether planners would be willing to consent alternative waste management uses for a landfill site which had previously been mothballed is less clear cut – unless such alternative use would eventually result in a fully restored site.

In Europe where comprehensive landfill bans are in place, landfills may be used as temporary storage facilities for combustible materials/RDF and if England moves to such bans, then this is a potential development opportunity.

7.2. Energy

For those landfill sites with existing landfill gas power generation, the development of alternative small scale (renewable) energy infrastructure is a natural development – using as it does the 'sunk' electricity grid connection costs.

According to WRG's website, eight locations have initially been identified as having the potential for onshore **wind farms** and at least two have already secured planning consent. Biffa too are reported to be progressing several sites.

Similarly **anaerobic digestion** – either of imported wastes or energy crops grown on the restored landfill represent possible development opportunities being pursued by a number of landfill operators.

7.3. Agriculture

Typically, the agricultural potential for former landfill sites has been limited for its use as **grazing land** – especially sheep.

WRG has recently announced that energy crops will be grown at 14 landfill sites across the East Midlands and Yorkshire with the objective that the resultant biomass will be used for power generation at Drax, whilst in a further development, 40 hectares of forage maize has been planned Oxfordshire with the aim for it to feed a 1.5MW anaerobic digester planned for the site.

Opportunities also exist for the use of lower grade composts and digestate derived from organic wastes to be used on site as part of a wider closed loop operation.

7.4. Leisure

The potential for former landfills to be used for leisure use has been long recognised – with golf courses the most commonly quoted (although, in fact, relatively unusual). Given that landfill sites are often located some distance from sensitive receptors and cover a reasonably large area, opportunities may exist for **relatively noisy leisure activities** requiring significant open space such as cross country driving, quad biking or clay pigeon shooting.

7.5. Landfill Mining

It is reported that there are plans for a landfill site in Belgium to be 'mined' for waste – which is thought to be the first of its kind in the world. The 30-year project will process up to16.5Mt of waste landfilled since the 1960s at the site near Hasselt in eastern Belgium.

The development is made commercially viable through a combination of rising recovered metal prices, rising power prices and brownfield remediation subsidies specific to Belgium. Currently in the UK the economics of mining remain generally unattractive, but there may be scope in the future for such operations to be commercially viable particularly where energy and recyclable values are high and if, for example, mining operators are eligible can reclaim landfill tax. More likely landfill mining may be required to re-contour an existing landfill which has had to close prior to meeting achieving planned completion levels.

Technical challenges too remain - including managing potential disamenity impacts (particularly from odour), as well as mitigating landfill gas ignition risks and the dangers to operatives associated with handling wastes about which there may be little information.

GLOSSARY

Active Waste	As defined in the Landfill Tax Regulations – typically HIC wastes
BMW	Biodegradable Municipal Waste
CAGR	Compound Annual Growth Rate
C&I	Commercial & Industrial
DEFRA	Department of Environment, Fisheries and Rural Affairs
EA	Environment Agency
EBITDAP	Earnings before Interest, Tax, Depreciation, Amortisation and Provisions (= cash generation)
EWC	European Waste Code
HIC	Household, Industrial and Commercial
Inert Waste	As defined in the Landfill Tax Regulations
LACW	Local Authority Collected Waste
MBT	Mechanical Biological Treatment
MHT	Mechanical Heat Treatment (autoclave).
RDF	Refuse Derived Fuel
Residual	Waste remaining after re-use, recycling and composting activities
ROC	Renewable Obligation Certificates
RWTF	Residual Waste Treatment Facility
SNRHW	Stable Non Reactive Hazardous Waste
SRF	Solid Recovered Fuel
WPA	Waste Planning Authority

APPENDIX 1

Central Case, Real		2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Tonnages	Total	175,000	157,210	149,147	142,421	135,567	128,583	121,470	114,226	106,853	99,348	91,713
	LACW	62,968	58,112	54,074	51,166	48,194	45,156	42,053	38,886	35,653	32,354	28,991
	C&I	71,734	60,986	58,915	56,728	54,508	52,255	49,969	47,649	45,296	42,910	40,489
	Inerts	40,298	38,111	36,157	34,526	32,865	31,172	29,447	27,691	25,904	24,084	22,234
Gate Fees	LACW	£23.00	£23.00	£23.00	£23.00	£23.00	£23.00	£23.00	£23.00	£23.00	£23.00	£23.00
	C&I	£18.00	£15.23	£12.45	£9.68	£9.68	£9.68	£9.68	£9.68	£9.68	£9.68	£9.68
	Inerts	£2.00	£2.00	£2.00	£2.00	£2.00	£2.00	£2.00	£2.00	£2.00	£2.00	£2.00
	Weighted, Active Waste	£20.34	£19.02	£17.50	£16.00	£15.93	£15.86	£15.77	£15.67	£15.55	£15.41	£15.24
Income	LACW	1,448	1,337	1,244	1,177	1,108	1,039	967	894	820	744	667
	C&I	1,291	929	734	549	528	506	484	461	439	415	392
	Inerts	81	76	72	69	66	62	59	55	52	48	44
	Total	2,820	2,341	2,050	1,795	1,702	1,607	1,510	1,411	1,310	1,208	1,103
EBITDAP Margin		35%	26%	18%	8%	5%	1%	-2%	-7%	-12%	-18%	-25%
EBITDAP		987	610	360	139	82	23	-36	-96	-157	-218	-279
Operating Costs	Total	1,833	1,731	1,690	1,656	1,620	1,584	1,546	1,507	1,467	1,425	1,383
Operating Costs	/t active	£13.61	£14.53	£14.96	£15.34	£15.77	£16.26	£16.80	£17.41	£18.12	£18.94	£19.90
	Fixed	£4.54	£5.13	£5.41	£5.66	£5.95	£6.27	£6.64	£7.06	£7.55	£8.12	£8.79
	Semi-Fixed	£5.07	£5.40	£5.55	£5.68	£5.83	£5.98	£6.16	£6.35	£6.57	£6.82	£7.11
	Variable	£4.00	£4.00	£4.00	£4.00	£4.00	£4.00	£4.00	£4.00	£4.00	£4.00	£4.00
	Fixed	611	611	611	611	611	611	611	611	611	611	611
	Semi-Fixed	683	644	627	613	598	583	567	550	532	513	494
	Variable	539	476	452	432	411	390	368	346	324	301	278

Figure A1.1 – Generic Landfill Assumptions for Falling Gate Fee

Model Assumptions

1. Landfill inputs mirror the declines in tonnages at a national level as identified for the Central Case in Section 4.
2. The site does not benefit from the closure of proximate landfills
3. 2010 gate fees
    a. for LACW is £23/tonne (as per Table 10)
    b. Residual C&I Waste it is £18/tonne
4. EBITDA margin is 35%.
5. No material real increases in the absolute level of underlying operating costs – either through legislation or general market inflation.

APPENDIX 2

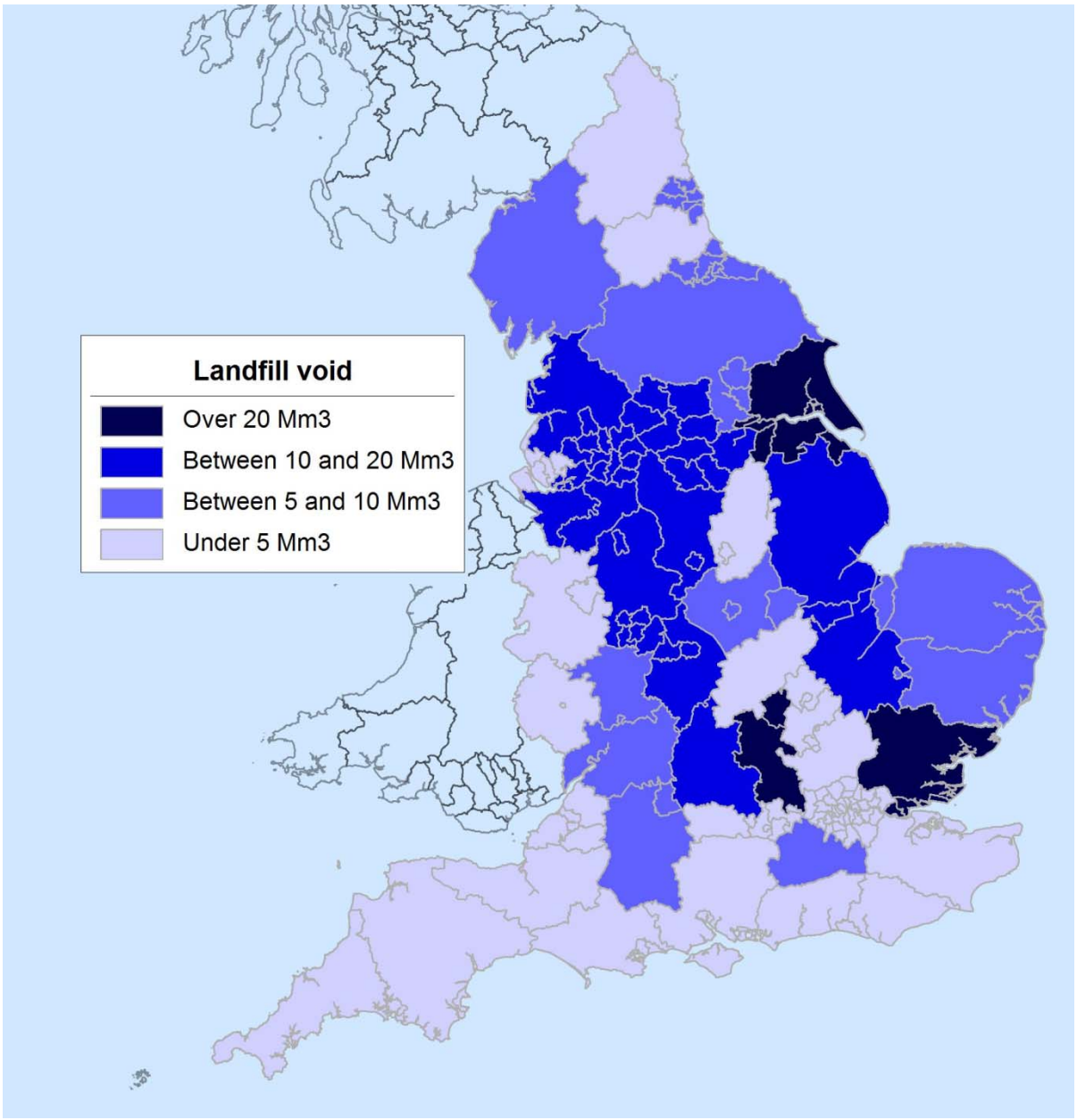


Figure A2: Sub-Regional Non-Hazardous Void

APPENDIX 3 – KEY REFERENCES AND DATA SOURCES

1 As used for high level analysis in *DEFRA Spending Review 2010 – Changes to the Waste PFI Programme* – PFI Change Analysis

2 EA: Report on the Landfill Allowances and Trading Scheme 2009/10 - November 2010

3 DEFRA: The Economics of Waste and Waste Policy

4 http://www.irishtimes.com/newspaper/ireland/2011/0425/1224295410351.html

5 DEFRA Environmental Permitting Guidance - The Landfill Directive Regulations 2007, Updated October 2009, Version 2.0

6 BDS Marketing, http://www.agg-net.com/news/uk-landfill-industry-has-10-years-remaining-void-life

7 http://www.environment-agency.gov.uk/research/library/data/97400.aspx

8 Tolvik: 2011 Briefing Report: Residual Waste in the UK – 2011 Briefing Report

9 DEFRA Survey of Commercial and Industrial Waste Arisings 2010 – DEFRA C&I Report

10 See Reference 1

11 Tolvik: 2010 Briefing Report: Residual Waste in England and Wales – 2010 Briefing Report

12 Norton Rose/Tolvik – The Future of Waste. A continuing opportunity November 2011

13 CEWEP Gate Fees – accessed via:

http://www.cewep.eu/media/www.cewep.eu/org/med_557/784_cewep_-_landfill_taxes__bans_29_september_2011_web.pdf

14 Gate Fee Reports 2008-2011

15 DECC: Digest of United Kingdom Energy Statistics (DUKES) 2011 – Table 7.4

16 Augean plc: Interim Statement June 2011

17 Arup for DECC: Review of the generation costs and deployment potential of renewable technologies in the UK