The Reality Gap

UK residual waste treatment capacity – making sense of the arguments

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A word from our CEO

Biffa is continuing to go from strength to strength, successfully adapting to new markets and extending our range of services and UK network coverage. We don't make a song and dance about things, we just get on with the job in hand, continuing to build on over 100 years of valuable experience.

I'm therefore delighted to present this report, which I feel very much reflects that practical and knowledgeable approach, applied to the subject of residual waste management capacity in the UK. In it, we look ahead to how we see the future playing out, not just in terms of a mathematical modelling exercise but also the influence of market dynamics on that, reflecting the realities of supply and demand.

I'm particularly proud that we have the skills and knowledge to be able to undertake this work in-house, allowing us to combine that with our commercial knowledge and produce a report which we hope you will find both interesting and insightful.

Ian Wakelin
CEO Biffa

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Even amongst the most sceptical analysts there is no disputing the existence of a substantial residual waste treatment infrastructure capacity gap in the UK, presently in the region of 15Mtpa. With the exception of one analyst, there is also a broad consensus that it will persist to at least 2025. Given the wide range of variables which can be selected to use in predictive modelling on the subject it is not surprising that there are differences in the conclusions of reports published so far, although there is also plenty of common ground.

There appears to be a consensus now that the prospect, in reality, of EfW overcapacity in the UK is a myth. Cautious private sector funders are simply not going to keep pouring hundreds of millions of pounds into building more large scale EfW plants without the market to support them. The UK is not starting from the same place as some other European countries and the impact that overcapacity elsewhere in Europe has had is to make UK project funders even more wary. Securing funding for UK EfW projects now, even with a substantial market, is challenging, unless you can secure the scale of feedstock volumes that Biffa controls.

Up to now, report conclusions have tended to be presented as straight maths: predict arisings using your chosen parameters, predict infrastructure development as a separate exercise, draw two extrapolated lines on a graph and where they cross is where the gap disappears. But will it? Really? Perhaps in the hypothetical world but developers and investors know that it's not quite that simple.

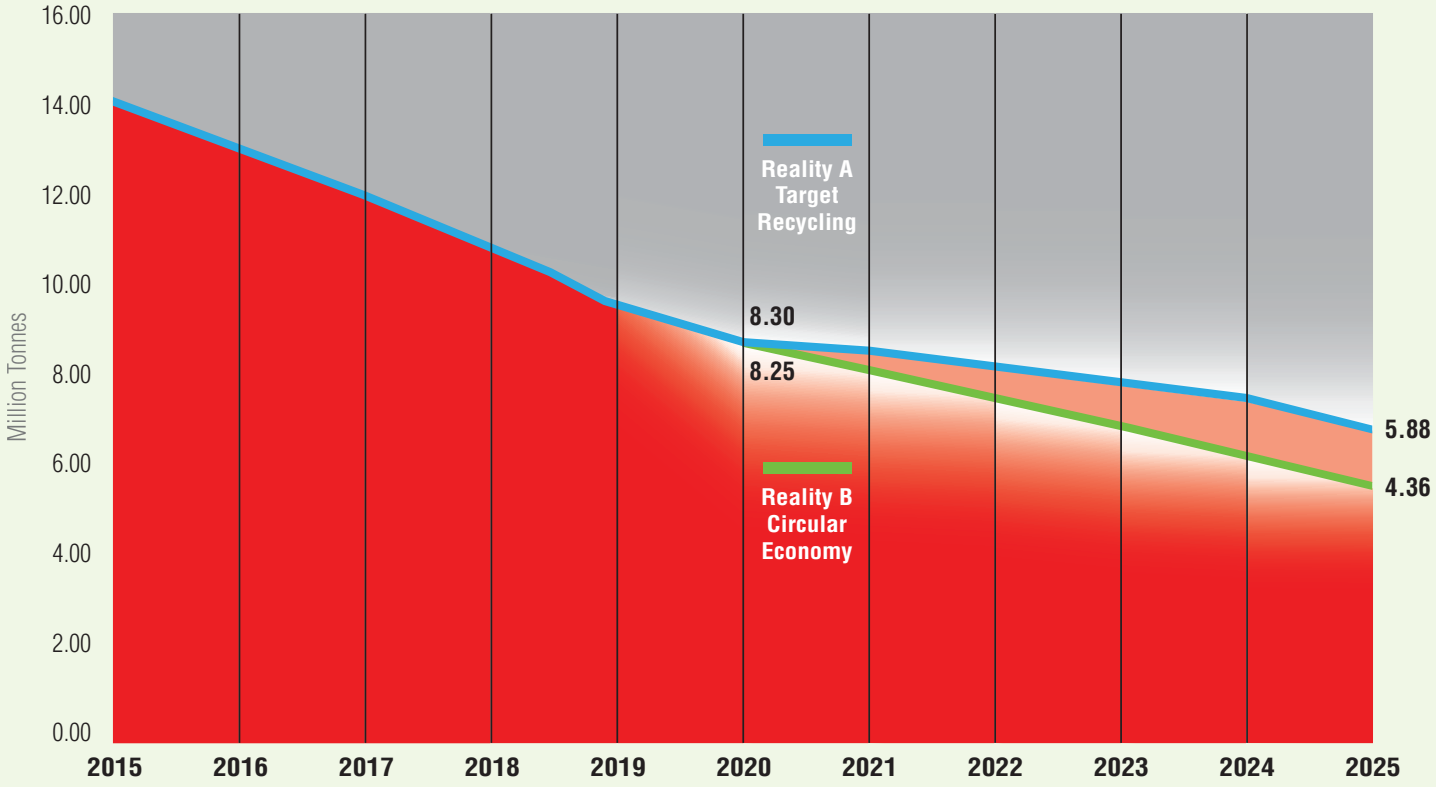
As with any market, supply and demand rule the roost. The lower the waste arisings (market), the lower the appetite for investment in major new infrastructure. Conversely, the bigger the market the greater the interest. Waste availability and infrastructure development are interdependent within any given scenario but this has not really been acknowledged in other reports. Where does this lead? Eventually to a UK residual waste treatment market too small and patchy to attract further investment in major new capital expenditure projects. Leaving a "residual" gap of residual waste treatment capacity – or rather a natural working balance - which will be a feature of waste management in the UK as it always has been, but on a smaller scale, with different opportunities.

In this report we highlight these issues of reality in relation to the residual waste (post recycling) market; the way we think the treatment capacity gap will change, the end result and how we deal with the remaining balance - the "Reality Gap", as we think of it.

Key Findings

- There is a substantial UK residual waste treatment capacity gap today in the order of 15Mtpa and this is likely to persist, reducing potentially to 4.4MTpa or up to 5.9Mtpa by 2025.
- Future waste infrastructure delivery in the UK is entirely dependent on private sector funding. Supply and demand will call the shots. Predictive mathematical modelling which ignores market dynamics and funding requirements is unlikely to generate realistic future scenarios, as are misleading comparisons with Europe.
- UK-wide analyses mask the geographical variations within the UK, which is what the markets relate to. Consequently, some areas with insufficient capacity coverage will see that situation continuing beyond 2025, where waste volumes are too small to support major investment. The capacity gap will therefore reduce, but will not disappear completely, once it reaches market equilibrium. However, the remaining balance can be managed by combinations of current solutions and potential smaller scale plants, if suitable scale-related, affordable and reliable technology can be developed.
- Operational capacity is the only capacity which can actually be used. A planning consent on paper is simply a potential means to an end, not an end in itself. Conversion of consented capacity into operational capacity is, ultimately, all that matters. For individual projects, specific market assessments will always be necessary, regardless of the overall UK averaged picture.
- Residual waste treatment capacity development goes hand in hand with recycling, both playing their respective roles. It is not an “either/or” choice. Statistics show this is the case in both Europe and the UK. MRF closures in the UK are not caused by EfW plants being built. The UK needs to address recycling in its own right.
- Current waste management options which help to address the UK residual waste treatment capacity shortfall will continue to be essential, including RDF export. Utilisation of existing landfill capacity is also going to remain important in the short term and the long term, as a general waste management back-up whilst additional treatment capacity is developed and for wastes which can only be landfilled.

Capacity Gap Scenarios



1. Introduction

The last five years have seen a number of studies published, some by consultants, some by waste management companies, analysing UK EfW capacity and the capacity gap. With the exception of reports by Eunomia, who predicted the UK capacity gap disappearing as early as 2017 in their original reports, followed by a theoretical over capacity after that, all other studies have predicted bigger and longer term capacity gaps, and hence a continued need for substantial UK infrastructure investment.

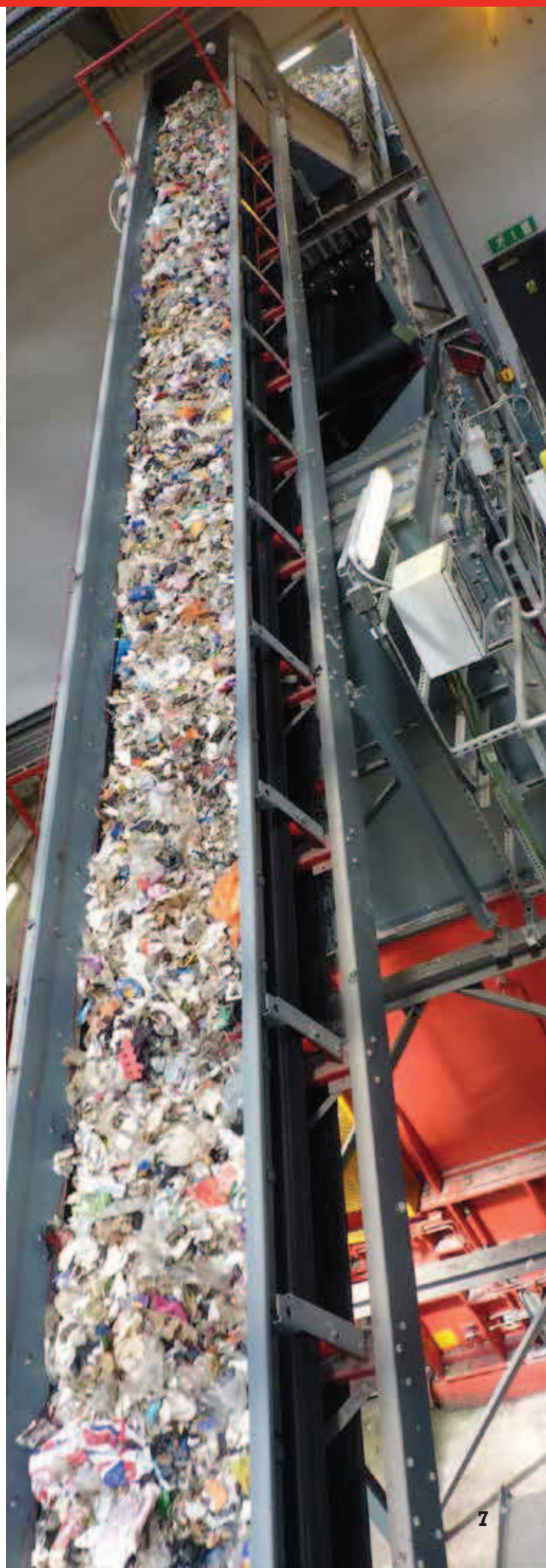
Analyses have tended to be presented as a straight mathematical gap analysis, setting predicted future arisings against predicted future capacity and seeing where the extrapolated lines cross. Whilst this sort of exercise may be useful for comparing the findings of one report against another, it masks important market dynamics relating to the geographical spread of infrastructure and the reaction of investors to a shrinking market (the market being the capacity gap in any particular geographical target area). Biffa has undertaken its own detailed analysis in terms of what we consider to be realistic future waste arising scenarios, the impact on that on "conversion" of currently consented UK projects into relevant operational capacity on the ground, the supply and demand interplay between those factors and the resulting balance.

2. How did the debate start?

The debate around EfW as a technology has raged for many years and, in recent years, has become intrinsically linked with debates over UK residual waste treatment capacity, due to its dominant role in that market by virtue of scale. Often the arguments are underpinned by entrenched principles, particularly from objectors to EfW, despite the significant advances in design and efficiency of modern combustion plants. However, campaign groups' concerns regarding historical models of public funding and long term MSW contracts appear to have subsided a little, with the growing realisation that the market has changed, with future investment in the UK being market driven and primarily reliant on commercial fuel supply contracts.

The last few years have seen new dimensions to the debate, sparked by a combination of high profile EfW planning appeal cases with the usual dose of politics; a new market in RDF exports since 2010 and, the same year, DEFRA public spending cuts resulting in withdrawal of PFI credits on seven major municipal waste contract procurements involving new EfW facilities. PFI credits on other EfW projects have been withdrawn in subsequent years. The debate has also widened, looking at waste treatment capacity as a whole, not just EfW's role and the scale and longevity of the capacity shortfall - or - if you are an investor looking at it from the other end of the telescope – the scale of the residual waste market in the UK.

In Dec 2011 consultants Eunomia started publishing six monthly Residual Waste Infrastructure Review reports, which claimed that the UK was heading for residual waste treatment overcapacity by 2017 (pushed back to 2018/19 in more recent reports). Since then the ball has kept rolling and has received regular, intermittent press coverage. Other analysts have published reports which predict a much greater and persistent UK treatment capacity gap. However, there appears to be one area of shared, general agreement in acknowledging that hypothetical overcapacity resulting from straight mathematical modelling is unlikely to materialise in practice, due to market correction coming into play. This latter point is essential in keeping the debate grounded in reality and is therefore a key component in Biffa's analysis.



3. General Issues

Making use of combustible residual waste as a potential source of fuel after you've first collected the materials which can be economically and practicably recycled is consistent with latest UK Government productivity policy ("Fixing the Foundations", July 2015), which includes developing more low-carbon, secure sources of energy supply. Western Europe has long recognised the benefits of EfW infrastructure, both from a waste management and an energy generation perspective. However, the UK has been dogged by political arguments about it and risks underutilisation of this potential. The figures show that in both Europe and the UK, growth in recycling has happened alongside growth in EfW so the idea that the latter blocks the former does not reflect reality. Recycling and residual waste treatment perform two different functions for different components of the waste stream, different markets and different gate fees. Biffa is a major operator in both recycling and in residual waste treatment and disposal, so knows this full well. There is still a lot more which can and should be done to improve recycling, such as creating greater demand/pull for secondary raw materials (commodities) and products made from recycled components, also by more "push" intervention requiring separate food waste collection and separate collection of bulk recyclables. Those aspirations are already acknowledged in our residual waste market scenarios.

Unfortunately, the theoretical overcapacity warning headlines have been used by some anti-incinerator campaigners to try and block live planning applications, particularly relating to MSW contracts, on the general basis that the UK capacity problem is now "solved" and there is no need for more facilities. However, such a simplistic and UK-wide approach ignores crucial factors such as the relationship between planning consents and conversion into real, operational capacity; commercial catchment areas and geographical coverage; the practice of speculative consent gathering and the difficulties in securing funding in a shrinking market. These factors are what shape what DOES get built, in reality, rather than what MIGHT get built, in theory.

Whilst Defra may, on the one hand, be able to stop at UK wide data for the purposes of demonstrating UK compliance with EU landfill diversion and recycling targets for Municipal Waste, on the other hand they should still be concerned about delivery of a sufficient geographical spread of residual waste management capacity on the ground. That is what is needed to be able to manage UK residual waste arisings and, as part of that, help generate our own secure, low carbon energy, where that is feasible. Where it is not feasible to do that there remains an important role for using existing remaining landfill capacity and/or continuing with taking advantage of European opportunities through RDF export. We need to recognise these challenges and opportunities quickly and, where relevant, link them more clearly to energy policy and the current Government productivity agenda.

RDF production: an example of market forces at work

Whilst capacity delivery in the UK has struggled in recent years, necessity has proved to be the mother of invention and UK innovation has come to the fore, tapping into the alternative fuel resource which residual waste presents. A successful Refuse Derived Fuel (RDF) production business has been established and has grown steadily since 2010, with the UK currently exporting around 2.5MT/year of RDF to Europe. Biffa now exports around 500,000 tonnes/year of RDF from our RDF production plants to European waste-fuelled CHP plants.

RDF exports have enabled UK waste producers to divert their residual waste from landfill and into energy recovery at European plants, at competitive prices, until the UK catches up and develops more domestic waste-fuelled power generation capacity of its own, including opportunities for CHP where they may exist. RDF export also makes use of current surplus European EfW capacity in countries which have found themselves in that position as a result of how they have historically funded and developed their infrastructure capacity differently to the UK.

The European apple and the UK pear

The current EfW over-capacity situation in parts of Europe which have created the UK RDF export opportunity is held up in some quarters as a "Ghost of Christmas Future" character, supposedly showing what will happen in the UK if EfW development here is not shackled by government intervention, such as refusing planning consent for future facilities. However, the history of EfW development in those European countries bears no similarity to the factors which drive future EfW development in the UK.

In Western Europe the current EfW over capacity situation in some countries is primarily due to the widespread development of publicly owned and funded facilities at a time when waste arisings were expected to continue growing and municipalities each funded and built their own facilities. Landfill bans in some cases also accelerated the growth in EfW plants and greater use was also made of CHP in many cases as part of major urban development or redevelopment projects, using the waste heat. By contrast, the UK has relied on landfill capacity availability for longer, has developed less EfW capacity overall and has seen more local authorities developing shared capacity. The UK now relies entirely on the private sector for future infrastructure delivery. Also, in the UK there have been very few new communities or major urban projects developed with CHP incorporated, due to fewer opportunities and less public sector house-building. Securing project funding for major new EfW projects in the UK is now recognised by all as the primary challenge and controlling factor, more so than the planning system, with perhaps the odd political exception.

Unlike in Europe, the market is therefore providing the current brake in the UK, through post-recession nerves and a continuing risk-aversion to funding plants not underpinned by traditional models of guaranteed long term local authority contracts. This is proving problematic even when the availability of feedstock generally, from commercial sources as well as municipal is not in question in many parts of the country. Such investment attitudes are perhaps slowly changing in response to the change in the market but this is where the Green Investment Bank (GIB) potentially has a key role in helping to overcome such blockages as investment models in new UK facilities begin to be re-thought. The existence of consented capacity on paper and on a UK-wide basis is therefore a very different thing from the delivery of a necessary geographical spread of operational capacity on the ground. In short, anyone comparing the current EfW over capacity situation in some Western European countries with the UK, and worrying about the same thing happening here, is making the mistake of comparing apples with pears.

No threat to recycling

Some campaigners have also argued that EfW overcapacity would suppress the UK's future recycling ability, preventing a potential 70% recycling target being achieved. However, evidence from Europe and the UK indicates that growth in EfW and growth in recycling tend to go hand in hand (Figs 1 and 2). This may well be a reflection of the fact that EU countries who are serious about tackling landfill diversion have tackled both aspects of the sustainable waste management chain.

Germany and the Netherlands, to whom Biffa currently supplies most of its exported RDF, both have higher MSW recycling rates than the UK, alongside high incineration and low landfill - or in the case of Germany, no untreated MSW to landfill at all following its ban in 2005. The German experience may suggest that their substantial public investment in EfW following their landfill ban has contributed to their current overcapacity. A general landfill ban in the UK would therefore not be the way to go, plus it could leave legacy issues relating to part completed quarry restoration projects. It would also ignore the vital role landfill plays for non-recyclable, non-combustible and specialised wastes in the long term, as well as its short to medium term role helping to plug the UK residual waste treatment capacity gap, especially in geographical areas with residual waste arisings too low to attract investment in new and possibly more expensive treatment infrastructure.

It is widely acknowledged that the challenges facing the UK recycling industry at present and going forward are nothing to do with the availability or otherwise of UK EfW capacity, which naturally competes with landfill in terms of gate fees, at the high end of the gate fees range, compared to MRFs at the low end (Fig. 3).

Fig 1: MSW treatment (%) – Europe

(source: EU Eurostat 2014)

Fig 2: Growth in incineration and recycling in UK

(Defra 2015 Waste & Resources Digest)

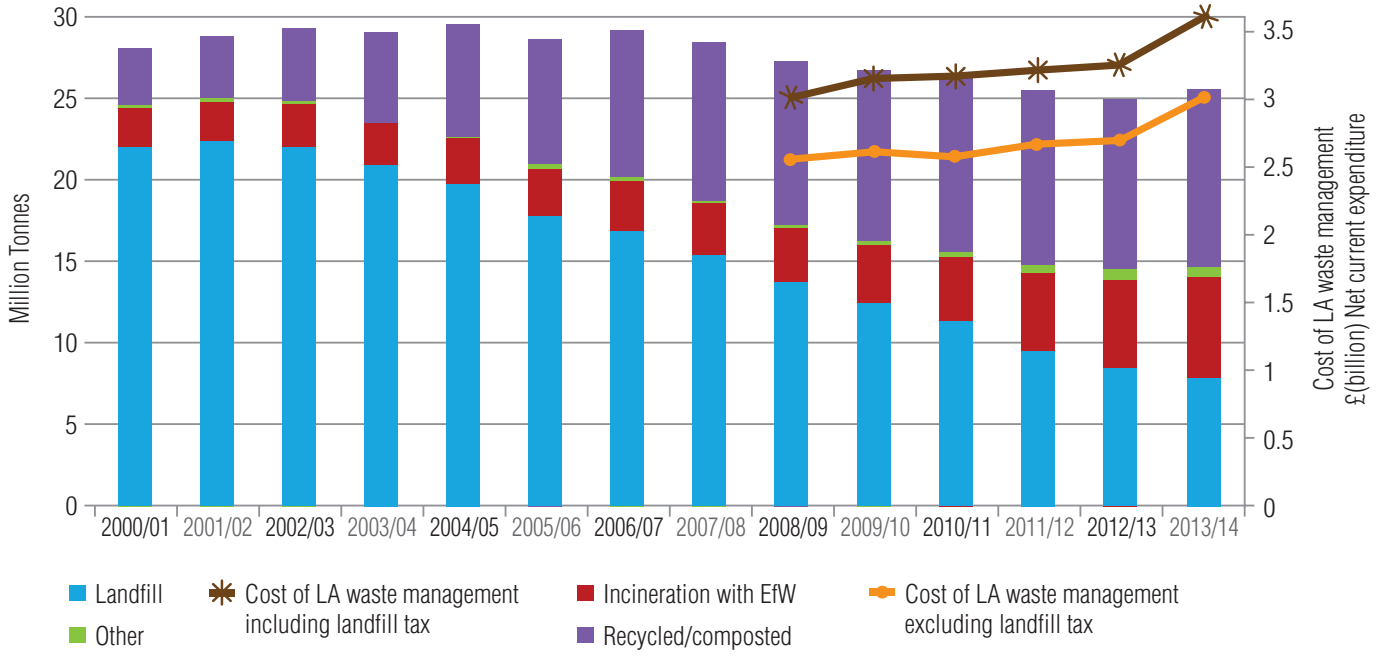
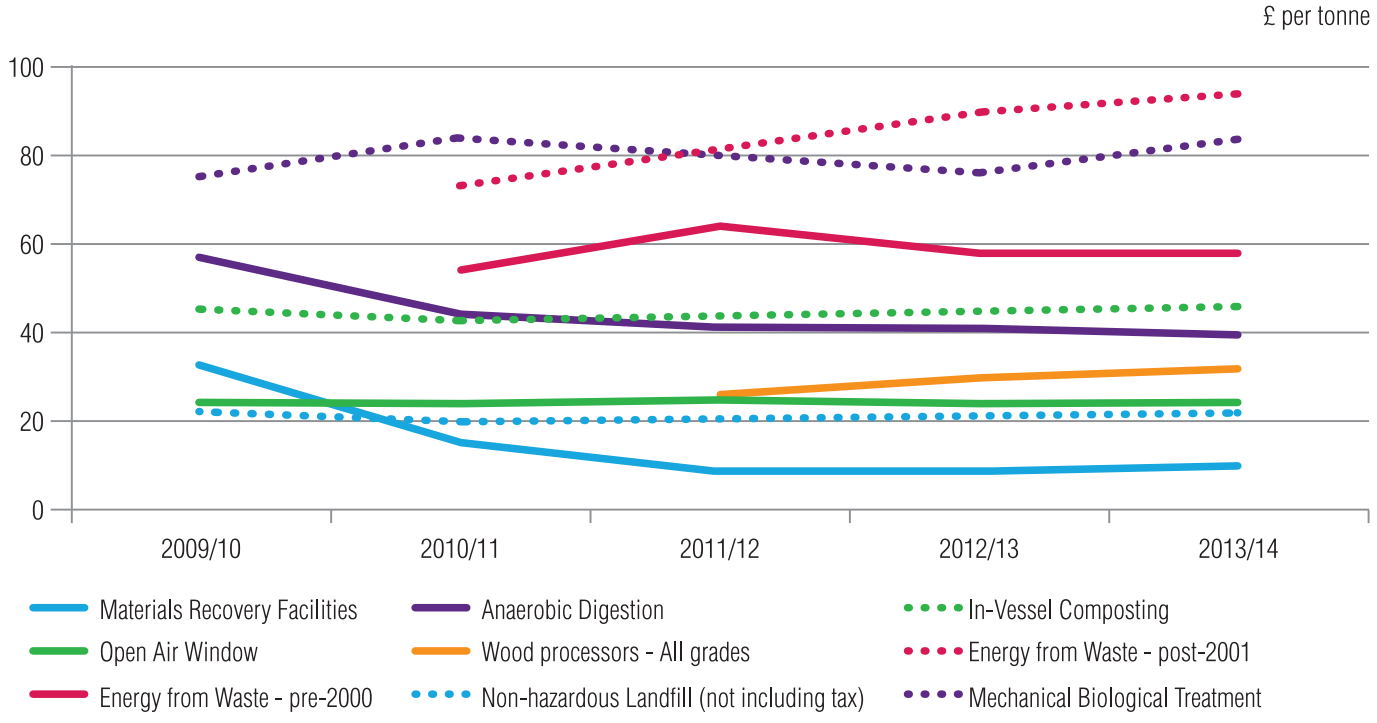


Fig 3: Gate fees comparison

(Defra Waste & Resources Digest, 2015)

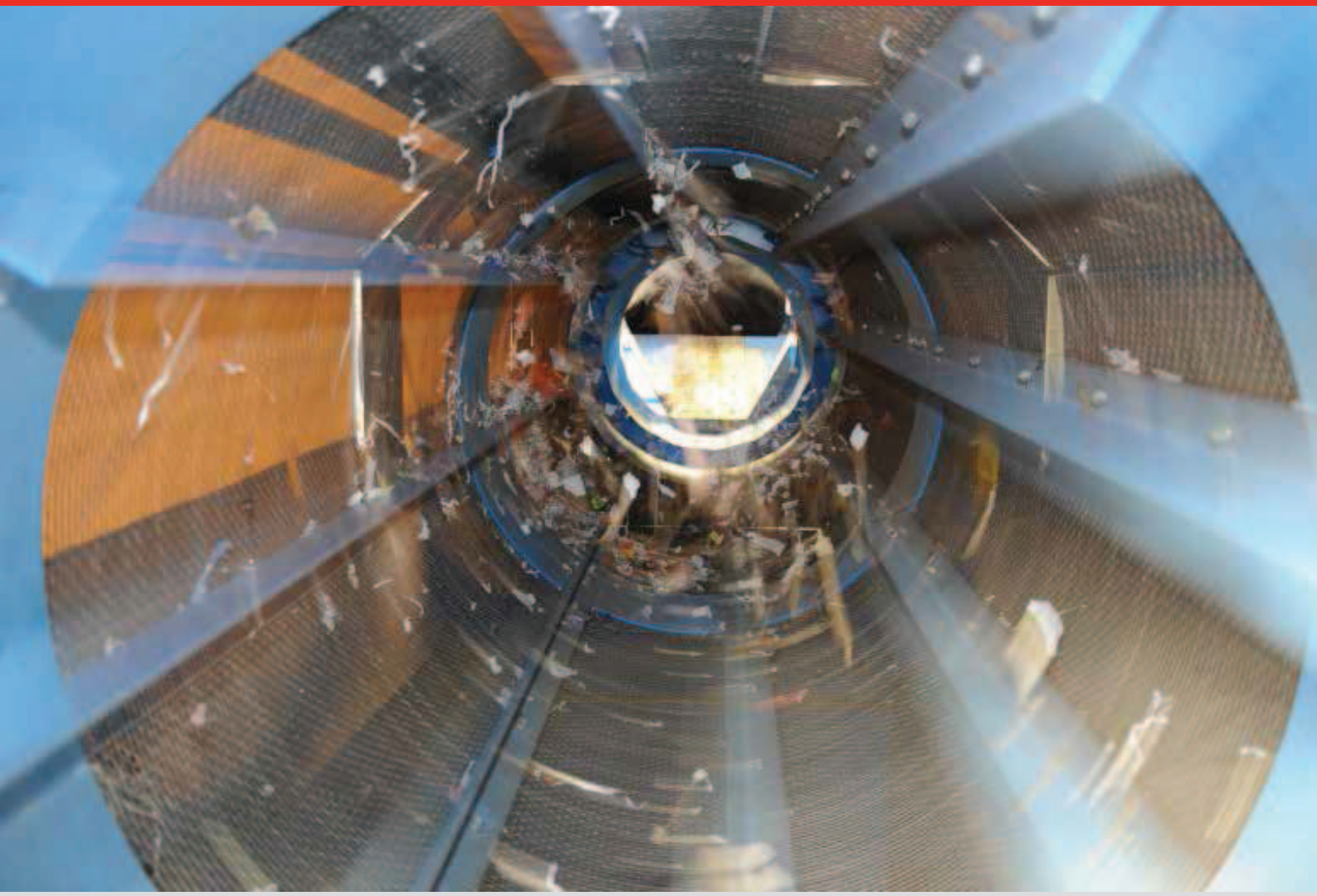


Risks to recycling and the reasons for some recent MRF closures relate to risks around commodity prices, some Local Authority contracts incorporating fixed prices for recyclates and weak "pull" factors, i.e. markets for products made from secondary raw materials (SRM). In terms of municipal waste recycling services, cuts to local authority budgets may also have an impact through, for example, cuts in services and reduced expenditure on recycling education and communication. As if to reinforce this, Q2 2014/15 Local Authority waste statistics figures for England show recycling only up by around 1% to 45% (from 43.9) but arisings up by 4%. There is more that could be done to improve recycling prospects by addressing these issues and also more focus on separate collection of food waste.

As a major recycling business Biffa fully supports measures to increase recycling. But for the recycling sector to survive and flourish it must be environmentally AND economically sustainable. There has been a lot of focus on environmental sustainability so far but not enough attention paid to economic sustainability. Self evidentally, recycling is not an end of pipe solution. It needs customers at the back end of the pipe as well as the front end and at the right prices for the equation to work. If recycling is not economically viable it either won't happen, or if it does, it won't survive, never mind how environmentally desirable it may be. Unfortunately that has been demonstrated vividly in the UK though closure of a number of recycling plants on commercial grounds. The UK needs to learn from that and tackle recycling in its own right, addressing pull factors as well as push factors, as recognised in Circular Economy debates.

Clearly recyclables need collecting separately from residual waste but trying to pull every ounce of remaining scrap plastic from a load of residual waste, using energy in the process and ending up with a low grade material with very limited, if any, market value is neither environmentally nor economically sustainable. Instead, the material's inherent economic and environmental value as an alternative, secure, low carbon fuel source for waste fuelled power stations can be recognised and utilised – making the important link between UK energy security and waste management objectives. If other, better markets for low grade plastics materialise in future and if UK plc makes more progress on alternative domestic energy capacity development, then the pendulum may swing in favour of it being worth additional processing to extract scrap plastics from residual waste. Meantime, Biffa's RDF fuel supply business provides a flexible and tonnage adaptable solution, which complements recycling, benefits waste producers by keeping costs down and recovers most readily accessible value from that material, in the form of energy. For the remaining material, or where energy recovery solutions are not viable, let us not forget that we still have a stock of usable and tonnage adaptable landfill capacity in the locker.

Anti-EfW campaigners' arguments have also, in the past, featured complaints about public subsidy of EfW plants and long term MSW contracts. However, neither of these is relevant in relation to new merchant EfW capacity development in the UK, which will depend entirely on the private sector and commercial fuel supply agreements for its provision. Private funders are far more risk averse than their public sector counterparts. Anyone trying to boost recycling by fighting future UK EfW development is therefore barking up the wrong tree and channelling their efforts in the wrong direction, which is unfortunate. If the traditional disconnect between UK waste policy and UK energy policy can be overcome we may even come to regard modern EfW plants as simply another variety of power station, which happens to use locally produced waste as a fuel instead of coal or gas, thereby also reducing reliance on imported coal and gas and helping with UK energy security.



The relevance (or not?) of UK-wide statistics

A UK wide assessment is relevant to central Government in terms of establishing the UK's EU Directive compliance position, but it is not especially helpful in relation to actual infrastructure delivery. This is because EfW plants (and other waste management facilities) serve smaller market areas within the UK. Regional analyses based on former local Government administrative regions, as some consultants' reports have attempted, are also of limited interest, since the economic catchment areas for facilities do not generally tend to reflect such administrative boundaries any more than other businesses do. In some cases they bear little relation at all to them, for example, waste from the north west of England being sent for energy recovery to the north east of England (Teesside). Individual facility catchment areas are impacted more by geography, transport routes and travel times, demographics and local market competition.

Consequently, investors will still want specific market and financial appraisals for individual projects, notwithstanding national level "overview"' reports. It is those project-specific studies which will determine what facilities get built. However, national level overview reports can have an impact on perceptions and market confidence, which is why it is important that the wrong messages do not get sent out and the right ones do.

Hypothesis v Reality?

Following publication of Eunomia's reports industry and other consultants followed with reports of their own. CIWM engaged Ricardo AEA who noted the need for an appropriate geographical spread, rather than a simple UK-wide assessment. They predicted a UK capacity gap ranging from 5 to 15M tpa in 2020. Sita and Veolia have published similar reports, Sita predicting a gap of 11.7MT in 2020, Veolia 11.3MT. Viridor has also highlighted unhelpful planning restrictions, particularly politically motivated catchment area restrictions on UK EfW plant planning consents. This latter example of over-regulation is also not confined to some EfW planning consents. Some Local Authorities have a dogmatic love of catchment area restriction planning conditions for all forms of waste facilities, even the sort of recycling facilities they are supposed to be encouraging investment in. This misguided, anti-competitive and harmful practice leads to sub-optimal usage of facilities and under-utilisation of capacity.

The Green Investment Bank (GIB) has also published a report (including analysis by Tolvik consulting) flying the flag for the major investment opportunity in the UK, due to the current and predicted capacity shortfall going forward, which they calculate at 4 - 7.7MT in 2020.

Tolvik themselves consider future UK capacity shortfall issues as part of their January 2015 report into the RDF market, anticipating RDF export to flat line at around 2.5Mtpa and, even allowing for that, still leaving a predicted capacity shortfall in the UK of around 6MT at 2020 onwards (their central scenario). If the RDF export volumes were to be deployed in the UK instead, an equivalent additional EfW capacity would be needed in the UK, making the UK gap correspondingly bigger.

In contrast to other analysts, Eunomia's conclusions predict the UK capacity gap disappearing much sooner. Their May 2014 report predicted the gap disappearing as soon as 2017 but in the latest version (June 2015) this has been revised to 2018/19 (with RDF export of circa 3Mtpa), or 2019/20 if no RDF export. The fact that Eunomia's capacity gap disappears sooner than others is a reflection of their choice of criteria and maths, also in the absence of market dynamics. They have a high projected consented capacity figure which appears to include projects Biffa either does not believe will materialise or does not believe will be suitable for general residual waste. Eunomia are also more pessimistic about waste arisings, i.e. the size of the market. However, the latest data for Local Authority collected waste in England (quarter 2, 2014/15, Defra provisional statistics, May 2015) actually shows waste arisings to have increased, by 4%, post-recession, with recycling only increasing by 1%. Given the selection of those two key variables in that way it, the result is two lines on a graph (arisings and capacity development) which are more sharply angled, one downwards the other upwards, hence crossing sooner than similar graphs by other analysts. Since that crossing point is the graphical representation of gap disappearance, this is why their capacity gap is shown as disappearing sooner than other analysts' predictions. Their predictive graphs continue to extrapolate the EfW capacity growth line beyond the crossing point at which the gap/market disappears, hence showing a pictorial representation of rising, future UK overcapacity. However, in fairness, their written report acknowledges that this is unlikely to materialise due to market correction which will impact on funding.

Unfortunately the theoretical overcapacity hypothesis is what appears to attract press headlines, which risks undermining market confidence further. This highlights the danger, in Biffa's view, of the debate becoming obscured by hypothetical lines on charts and planning consents on paper, rather than concentrating on current under capacity, its geographical variation, how the picture will change and how best to address it, in reality.

Fig 4: Biffa example EfW design, image courtesy of SLR Consulting

5. Biffa's own research: the ''Reality Gap''

Biffa believes that the debate has become obscured by an over reliance on theoretical, mathematical modelling. Whilst it is important to undertake that, a reality check needs adding, both generally and in relation to project "conversion" at local level. The reaction of investors to a shrinking capacity gap, both generally and from an individual project perspective, will have a fundamental impact on the conversion rate of approved capacity on paper into operational capacity on the ground, after the theoretical modelling has been done. Other reports generally only present a direct comparison between arisings and future capacity, extrapolated on a graph until two lines cross and the gap between them disappears. That may have some "benchmarking" use in terms of comparing different analyses, but it is not how the scenario is likely to play out on the ground.

As well as reviewing other published reports, Biffa has undertaken its own detailed analysis, underpinned by our own comprehensive database of UK residual waste treatment projects. We have considered a wide range of scenarios relating to residual municipal and I&C waste arisings, cross checked against published Defra data and, from that, selected the scenarios we consider most realistic and matched them against the future capacity scenarios as influenced by our analysis of the prospect of market support for individual projects and the sector in general – the supply and demand factors. From that a realistic future operational capacity can be devised, stripping out factors which can skew such forecasts, such as an over reliance on planning consents, inclusion of facilities or capacity which is unlikely to be suitable and over optimism about delivery and funding for some ATT technology proposals.

Waste Arisings forecast (prior to recycling)

Data on residual MSW is annually reported and is generally good. As we move out of recession recent data for MSW arisings is starting to show an increase again (UK 2013/14 arisings up by 2.3% at 25.6MT – Defra Digest of Waste & Resource Statistics, January 2015, with provisional figures for Sept 2013 to Sept 2014 for England showing a 4% increase). Going forward, household growth is considered to have proportionately more impact on waste arisings than population growth and, when considered in the context of the current Government programme to increase house-building significantly, with focus on brownfield development, household growth is likely to have an increasing influence. In contrast, national data on I&C waste is less accurate relying on the 2009 survey and the Defra 2015 Waste Digest (2012 data) although again, moving forward out of recession, Defra predicts waste growth.

After consideration of a large number of scenarios, a small, 0.5% growth/year for MSW arisings is considered appropriate for modelling, bearing in mind population and household growth. For I&C waste, 44% of that is generally accepted by Defra as being "MSW like". Again, various growth scenarios were considered, with two being considered appropriate for modelling: 1.4% pa growth (in line with Defra forecasts) and 1.4% pa until 2020 with 0.5% thereafter.

Reductions from recycling

Published UK MSW recycling rates stood at 44.1% in 2012 and 44.2% in 2013. The current EU target is 50% by 2020, with the prospect of a new Circular Economy target of 70% by 2030. I&C waste recycling rates based on 2009 Defra data of 52% are projected by Defra to increase to 62% by 2020.

3 scenarios for MSW and I&C waste are considered for modelling, as follows:

MSW recycling scenarios:

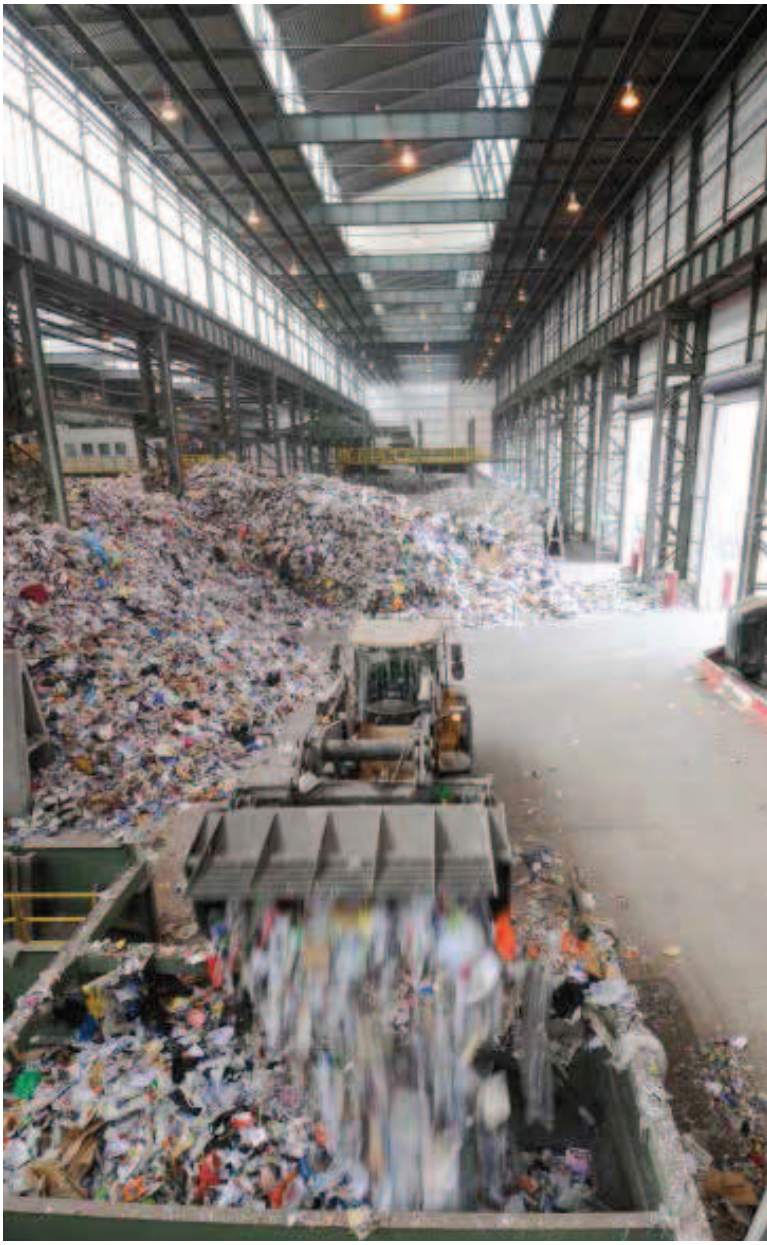
- Low: Existing rates 44% (2014) flat through to 2025
- Target: 50% recycling in 2020 and then flat to 2025
- High: 50% in 2020 increasing to 60% in 2025 to achieve 70% by 2030

I&C waste recycling scenarios:

- Low: Existing rates (52% in 2009) plateau with no additional improvements through to 2025
- Target: In line with DEFRA prediction of 62% by 2020 and then flat to 2025
- High: As above but continued increases between 2020 and 2025 at a rate of 1.6%pa

Modelled residual waste volumes range

Modelling the above growth scenarios against the above recycling scenarios generates a range of potential arisings available for further treatment in 2025 between 19.6Mtpa and 27.06Mtpa.



The role of RDF export

RDF export will continue to play a vital role and provide UK waste producers with a cost effective, non-landfill option, taking advantage of the spare capacity available in Europe. We share the view of Tolvik and most others that this is likely to continue at present rates of around 2.5MT per annum and that has therefore been incorporated as a constant.

There are two ways of factoring the RDF export contribution in: it can be regarded as a contribution to UK capacity (as we have done) or it can be deducted from UK arisings. However, either way, should that domestically produced RDF volume be deployed within the UK, instead of being exported it would therefore require an additional 2.5Mtpa of UK EfW capacity provision.

Future UK residual waste treatment capacity and its make up

Biffa has compiled an extensive and detailed business intelligence database of all known UK residual waste management facility projects, upon which the following findings are based.

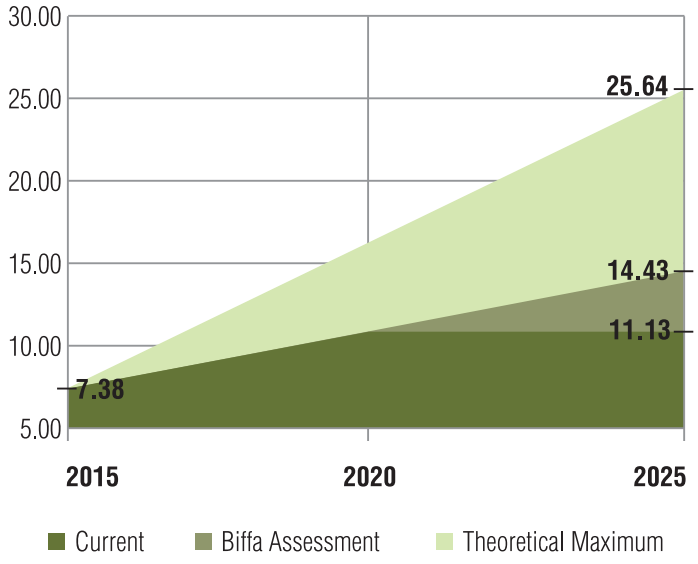
EfW (incineration)

By EfW we refer to direct incineration technology. This by far provides the greatest capacity of all relevant treatment technologies. Consequently, it, also results in the biggest contributory factor to the range in predicted capacity in the other studies, particularly the Eunomia studies. Others, including our own, are more cautious in their expectations. As already noted, for large scale EfW projects funders typically look for safety margins of available suitable feedstock in multiples of plant capacity.

For EfW we consider three future capacity scenarios:

- Low: nothing above that in operation or under construction is delivered
- Medium Biffa's assessment of additional projects which will be delivered
- High: All known projects are delivered. Whilst we know that this will never be a realistic scenario it helps to understand where other studies may have generated their numbers.

Fig 5: EfW Delivery (M tpa)



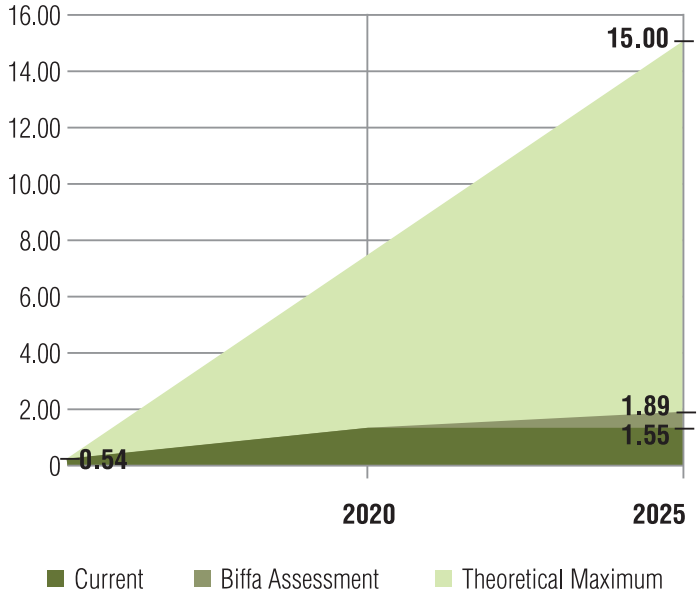
Advanced Thermal Treatment (ATT)

For the purposes of our analysis, ATT describes technologies such as gasification or pyrolysis solutions for the treatment of residual MSW and I&C waste streams. This excludes purpose-designed biomass power stations, which we consider are unlikely to be suitable.

Biffa considers 3 scenarios:

- Low: – nothing above that in operation or now in construction is delivered
- Medium: – Biffa's opinion on projects that will be delivered. This is a pessimistic assumption based on high project failure rates to date, further weakened by the impact of CfDs on revenue and the recent news that the October 2015 CfD auction is to be postponed due to a Government review of Renewable subsidies - we expect more clarity on this in the Autumn 2015 Spending Review.
- High: all known projects are delivered. Whilst we know that this will never be a realistic scenario it helps to understand where other studies have generated their numbers.

Fig 6: ATT Delivery (M tpa)



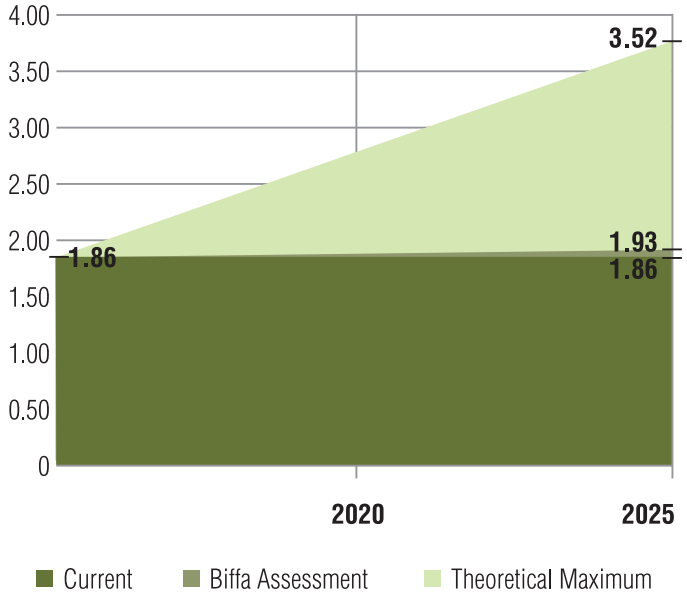
Mechanical & Biological Treatment (MBT)

For the purposes of the assessment, MBT describes processes that sort residual waste streams and create RDF and other outputs that can be further treated through thermal or anaerobic digestion processes. To calculate the 'treatment capacity' it has been assumed that only 40% of the plant capacity actually treats waste. 60% then returns to the market requiring further treatment i.e. RDF

Biffa considers 3 scenarios:

- Low: - nothing above that in operation or construction now is delivered
- Medium: - Biffa's opinion on projects that will be delivered
- High: all known projects are delivered. Whilst we know that this will never be a realistic scenario it helps to understand where other studies have generated their numbers.

Fig 7: MBT Delivery (M tpa)



Others: Autoclave and SRF/ Cement Kilns

Autoclave is a popular solution for sterilising infectious clinical wastes, however as a general waste treatment technology it has experienced significant technical and financial issues in recent years and is not anticipated as playing a major future role. Of 2.9M tpa of proposed schemes Biffa only considers one scheme (Shanks Wakefield PFI) being in operation through the review period.

As regards SRF/Cement Kilns, high grade RDF is often pelletised for specific kiln fuel feed requirements.

Historic demand fluctuations have caused nervousness regarding reliability of the end destination. Where alternative fuels are utilised it is often a blend of many materials such as shredded tyres/dried sludge, etc. SRF may account for as little as 25% of the total inputs. Again, this provides a relatively small contribution to UK capacity.

Fig 8: Autoclave

Autoclave	2015	2020	2025
Current	0	0	0
Biffa Assessment	0	40	40
Theoretical Max	0	1,448	2,895

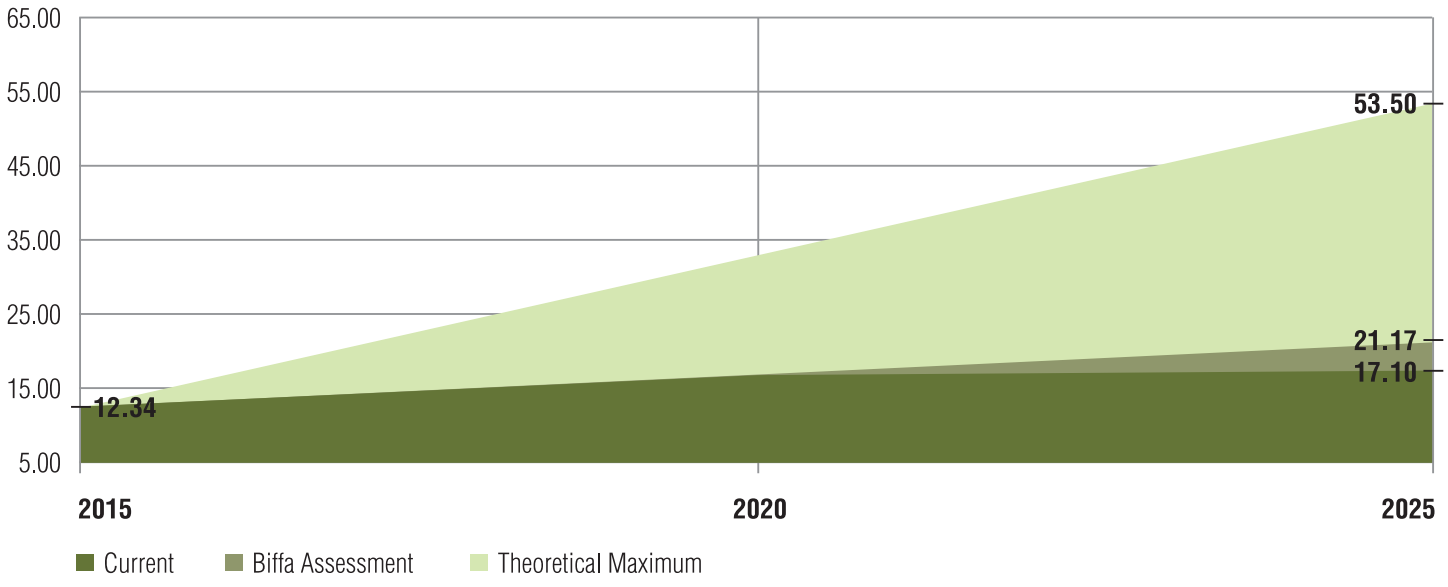
Fig 9: SRF

SRF	2015	2020	2025
Current	120	120	120
Biffa Assessment	120	305	499
Theoretical Max	120	681	1, 242

Total predicted treatment capacity

Combining the three scenarios for each form of treatment gives the range on the graph below (Fig 10). However, as noted, the theoretical maximum is purely a mathematically derived figure, based on all known projects being delivered, and is included simply to illustrate the very large numbers which can be presented if an appropriate reality check is not applied.

Fig 10: Total Treatment Capacity (M tpa)



Capacity Gap: The Reality Gap

As with any statistical exercise, selective maths can produce a huge range of results, in this case ranging from 34Mtpa of hypothetical overcapacity in 2025 if all consented projects carried on to full development and money were no object, to an under capacity of 9.5Mtpa if nothing got developed. Clearly these two hypothetical extremes are of no use for serious strategy planning, other than to serve as a warning against using unrealistic scenarios.

With the demands of project funders already referred to it is inconceivable that projects that result in over capacity will ever achieve delivery. Similarly, significant under capacity is unlikely due to the number of consented projects and the eagerness of many developers to realise their projects if they can secure feedstock and funding. The likely capacity which will get developed is therefore a clear result of supply and demand. The more waste in the market requiring treatment the greater the level of capacity that can be sustained, with the reverse also being true.

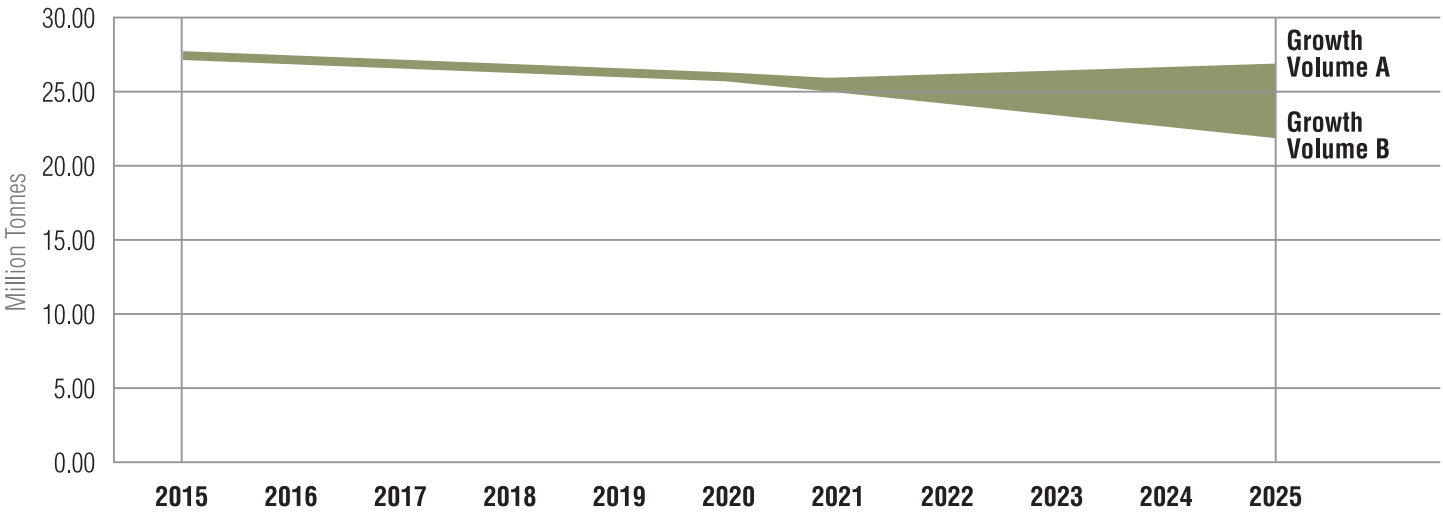
To narrow the range and generate a realistic capacity gap it is therefore essential to accurately predict the volumes of waste that will exist in the market alongside how the market is likely to react.

For the purposes of this review 2 scenarios are selected as those which are most likely to occur:

- Growth Volume A + Target recycling:
  - Annual waste growth of 0.5% pa MSW and 1.4% pa I&C
  - 'Target' recycling (50% recycling achieved for MSW and 62% for I&C) by 2020 and stable through to 2025
- Growth Volume B + Circular Economy:
  - Annual waste growth of 0.5% pa MSW and 1.4% pa for I&C up to 2020 and then 0.5% thereafter
  - High recycling (50% MSW in 2020 rising to 60% by 2025 and 62% I&C rising to 68% by 2025).

The use of High Volume A and High Volume B creates a range of residual waste in the market of between 27.06 (A) and 21.92 (B) Mtpa as shown in Fig 11 below:

Fig 11: Residual Waste Volumes



Given the underpinning assumptions of both target recycling and the circular economy impact this is deemed to be a reliable and safe baseline for calculating the gap in capacity for both 2020 and 2025.

Combining the volume (feedstock market) ranges with the predicted realistic capacity provision in response to those market scenarios leads to two potential capacity gap outcomes modelled up to 2025, which we refer to as "Reality A" and "Reality B". Reality A is the scenario of higher waste arisings (current Target recycling) and correspondingly higher new capacity investment, Reality B is the scenario of lower waste arisings (Circular Economy), with correspondingly lower new capacity investment, as depicted in Fig 12 below.

Fig 12 – Reality scenarios

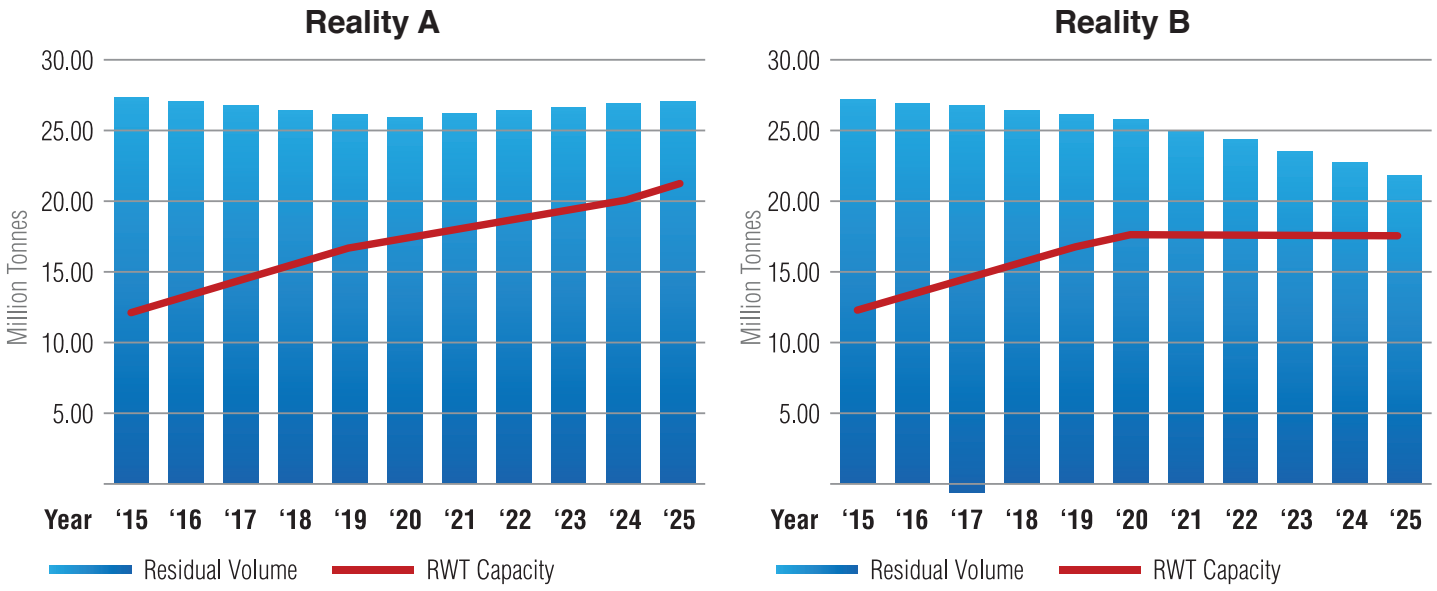
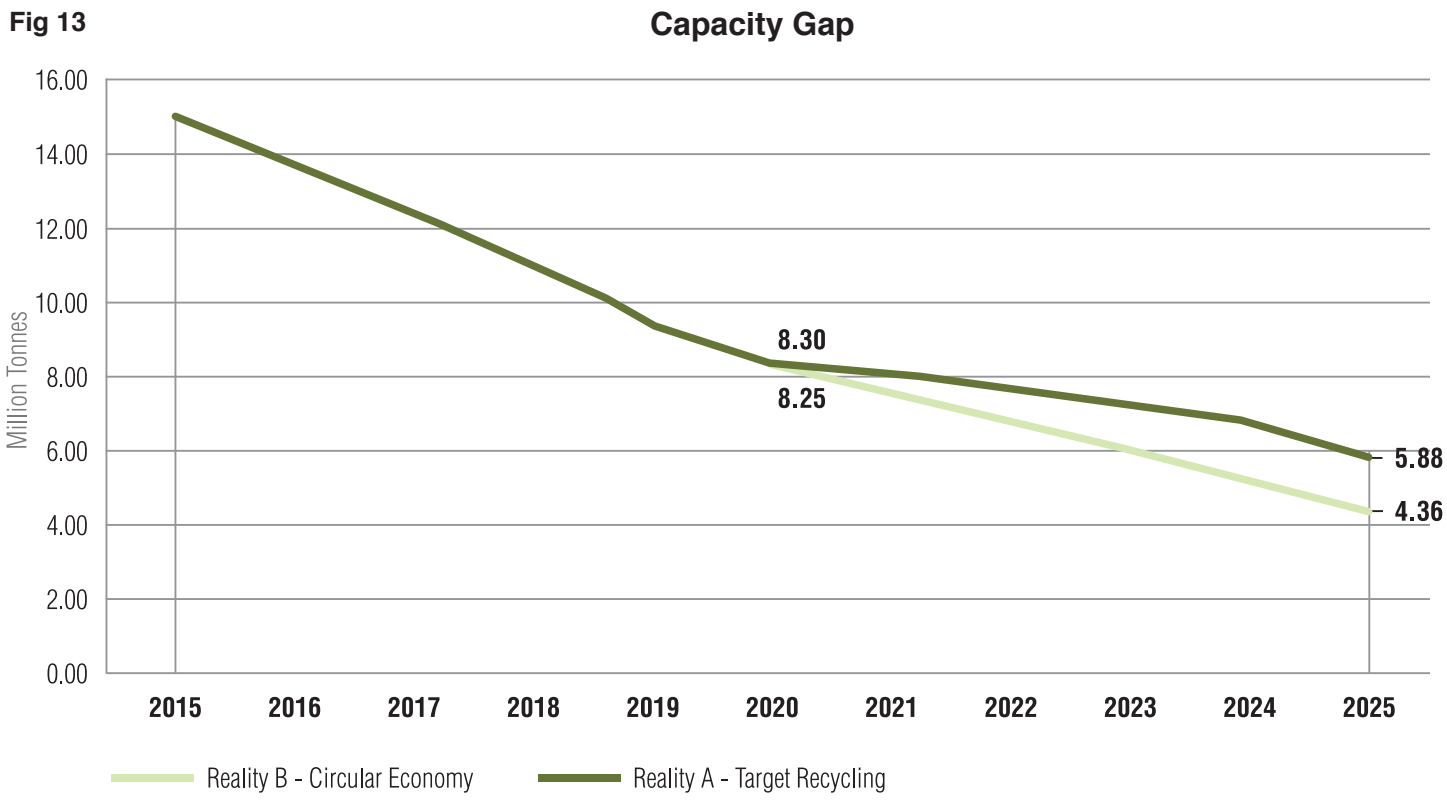


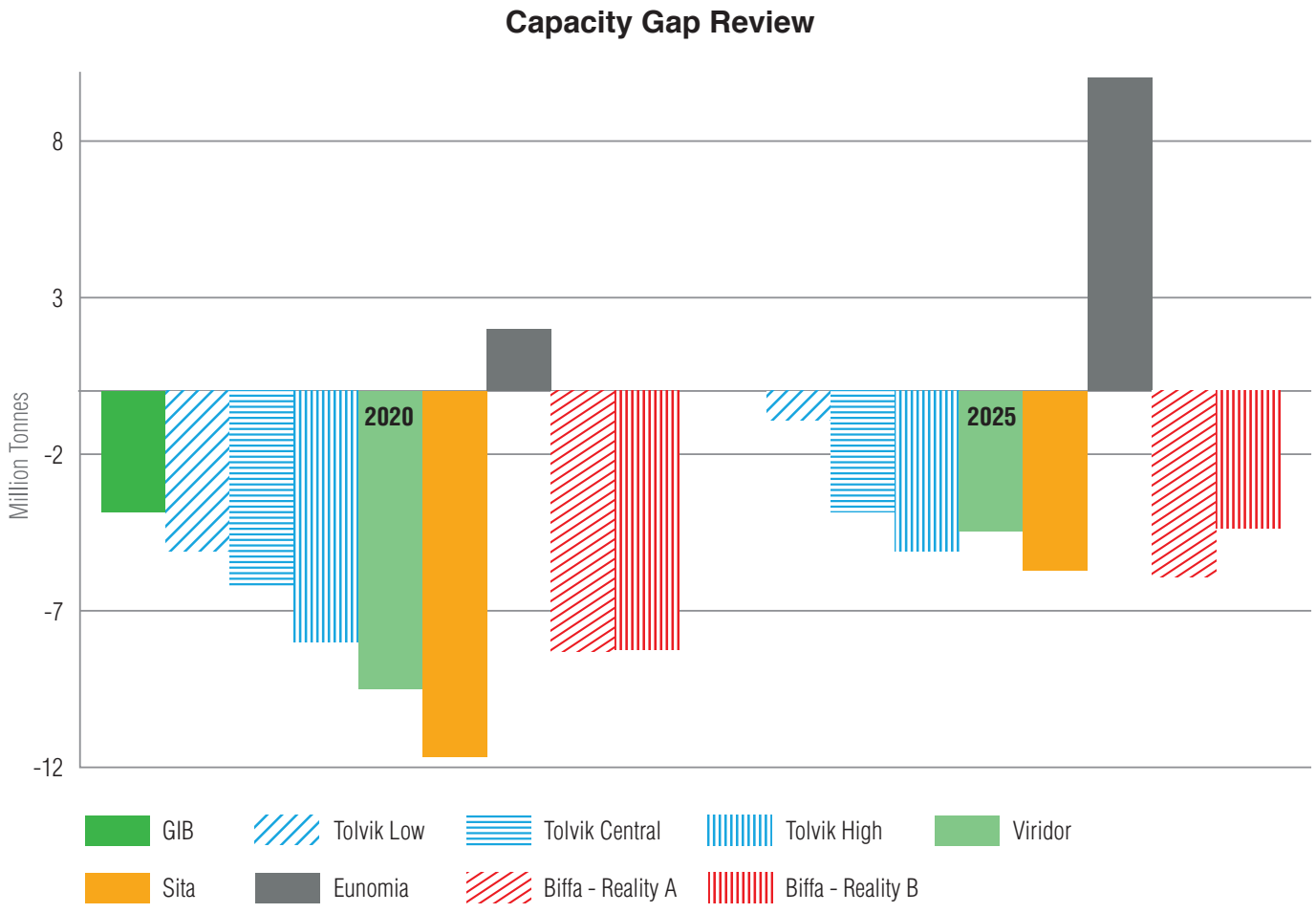
Fig 13



6. Benchmarking: capacity gap analysis comparisons

As can be seen from the comparison below, Biffa's analysis compares favourably with others, with the exception of the Eunomia reports.

Fig 14 - Benchmarking



7. After 2025: The remaining balance - The Reality Gap

Contrary to hypothetical predictions of overcapacity, in reality Biffa believes that the calculated capacity shortfall on a UK-wide basis will never entirely disappear. We agree with others that the treatment capacity gap will continue to reduce, in one of two probable ways in our view, but the geographical patchiness and the feedstock availability requirement needed to secure project funding for major projects (typically multiples of proposed plant capacity coverage in terms of fuel supply availability) will mean that a permanent treatment capacity gap - or balance - will always remain. Indeed, it would be a remarkable coincidence if future infrastructure development matched the gap.

Funders who are already nervous, even with the current UK capacity shortfall (market opportunity), will become increasingly nervous as the gap (market) reduces, until the point where the remaining market is too small and scattered to provide an attractive investment. This will be experienced at a local level where the market in certain areas of the UK will not be attractive enough for investors, leaving geographical shortfalls – "cold spots" - and hence, when combined, a persistent UK treatment capacity shortfall. We believe this simply represents an inevitable equilibrium in the UK market – a working balance.

Rather than continuing to regard this remaining balance as a "gap", it should be recognised as the natural settling point for the UK residual waste treatment market. Although the reduced scale and patchy coverage of the treatment capacity shortfall will not provide the necessary climate for much, if any, new major EfW project development beyond that which is already in hand, the waste arisings can still be managed by use of other means, depending on location. This may include, inter alia, the use of existing accessible landfill assets, further RDF export (depending on access to European markets) and, possibly, smaller scale advanced thermal plants designed to achieve greater efficiencies and less reliance on CFDs than some of the ATT proposals to date which have failed to secure funding. Existing landfill assets can help manage a share of the balance whilst new treatment infrastructure comes forward, also stepping in during annual EfW plant downtimes. In addition to the remaining balance of residual waste treatment capacity shortfall will be the remaining portion of non-recycle, non-combustible and specialist waste streams which will continue to require disposal by landfill as the most appropriate environmental option for such materials. These waste management options are tonnage adaptable components of the suite of management methods the UK is going to continue to need, in the short, medium and long term.

Biffa is a key provider of these services and is strongly placed due to controlling major tonnages of residual I&C waste feedstock. In that sense we are clearly differentiated from speculative EfW developers with no control over feedstock. Having a good understanding of feedstock and fuel supply logistics is important to be able to place that material into the most appropriate part of the available outlet portfolio, providing cost effective and reliable solutions for UK waste producers. Going forward there may also be opportunities for more refined forms of fuel products such as SRF or fuel pellets.

What this also shows is that, like Biffa, the UK is actually well placed going forward. By not putting all its eggs into one basket, the UK has a good range of options available to it, a healthy development pipeline for new infrastructure and the ability to respond flexibly as we make further progress towards a Circular Economy. But we need to keep all options open and available.

In a similar way to how "full employment" in the UK is generally accepted as including a working balance of unemployment, it is perhaps also time we should apply a similar level of realism to the notion of "full waste management capacity" in the UK residual waste market, acknowledging that it will necessarily include a working balance of treatment capacity shortfall, together with a legitimate landfill role for waste requiring landfill – the vital base which supports the waste hierarchy and without which it would collapse. That is not a failure scenario, it is a getting the balance right scenario.

Biffa UK coverage

Customers

94,000
Customers Nationwide

Our service success rate
99%

Company

Over
6,000
Staff

Our revenue per annum
£900m

Process

Weekly collections
2.6
million

624.000 tonnes
diverted from landfill last year

Safety

All operating divisions awarded
5 stars
in H&S Management

Reporting of near misses and hazards up
60

APPENDIX - Technical notes and definitions

Refuse Derived Fuel (RDF)

RDF grades

Various grades of RDF (and SRF - Solid Recovered Fuel) can be produced. The majority of RDF, which is currently exported from the UK, is generally referred to as "coarse" grade RDF. It is predominantly residual MSW and I&C waste which has been subject to segregation/sorting and a mechanical process (eg shredding) before being baled and wrapped.

ATT (Advanced Thermal Treatment) facilities normally require a more refined grade of RDF (higher specification) which increases the cost of production of the RDF required.

SRF (produced for use in e.g. cement kilns) is a further refinement (usually associated with a higher CV, lower moisture content, Chlorine limit and smaller shred size) and is again more expensive to produce. There is some SRF produced in the UK which is exported either direct to cement kilns or to blending sites in Europe.

Destination countries

The key countries that RDF is exported to are those predominantly in close proximity to the eastern seaboard of the UK. This allows the loading of RDF onto ships at eastern UK seaboard ports and a short sea journey to the importing country. The RDF can either (i) be loaded onto curtain sided trailers; (ii) into ISO shipping containers or (iii) temporarily stored in bales before being transported in bulk by specialist bulk transport ships carrying 2-3000 tonne loads.

Destination countries include:

- Holland;
- Northern Germany; and
- Scandanavian countries including Sweden and Denmark

Spare capacity at European EfW facilities

There is current spare capacity at many EfW facilities in mainland Europe through inter alia (i) less waste arisings due to the recession, and (ii) the success of waste minimisation/recycling. In addition many of the European EfW facilities were planned, sized and funded by municipalities when it was still assumed that waste tonnages would continue to grow at a rate of 2-4% per year.

UK portfolio of EfW facilities still being built

The current portfolio of UK EfW facilities has been financed primarily on the back of long term local authority PFI/PPP residual MSW projects. New UK capacity has therefore largely been built to service residual MSW rather than residual I&C waste. The UK portfolio of facilities is still being constructed and capacity will continue to become operational through to 2020/2025. Whilst capacity can therefore be estimated it is clear that at the current time, and for some time yet, there is insufficient capacity to process the amount of residual waste in the UK that could potentially be thermally treated.

It should be noted that the majority of UK facilities were designed to process a proportion of residual I&C waste but most likely at an assumed gate fee higher than that currently being charged for RDF exports.

Waste acceptance criteria/RDF specification

RDF is being exported to predominantly moving hearth grate technology EfW facilities. These facilities are able to accept a wide composition of waste input which is attractive to the exporter as waste is an inhomogeneous material.

Length of RDF export contracts

Many of the EfW operators in mainland Europe are prepared to enter into short term contracts. They do not have to worry about the usual UK Project Funding requirements (for new facilities) which normally require long term 15+ year contract terms. This suits RDF which is created using UK residual I&C waste as it "mirrors" the contractual arrangements (short term) which the waste management company/RDF producer has with its waste producer customers.

EfW destination facilities have Recovery (R1) status

In the majority of cases waste can only be moved out of the UK if it is being transported for Recycling or Recovery purposes. All of the European EfW facilities that accept RDF from the UK have Recovery (R1) status. This designation is set out within the Waste Framework Directive and is used to demonstrate the energy efficiency of the facility.

In mainland Europe the majority of EfW facilities

are CHP (Combined Heat and Power) facilities. This allows them to not only generate electricity but also export heat in the form of steam or hot water which can be used by industry or in district heating networks. This means that they are often significantly more energy efficient than UK EfW facilities, which are only generating electricity, as they have not been able to connect to a viable heat off take.

Environmental Performance
A number of the Dutch EfW facilities have shown (through the use of WRATE type environmental assessment modelling) that their improved environmental performance, through the use of CHP, significantly exceeds any environmental disbenefit associated with the RDF transport.

Technology

Energy from Waste (EfW) – incineration
EfW facilities have a number of advantages over other forms of waste processing - including:

Proven technology
EfW in the form of direct combustion, moving hearth grate technology is a tried and tested technology and has continued to be refined and improved. This allows EfW facilities to be more easily Project Financed provided waste supply requirements have been met.

Energy efficiency
Modern EfW facilities are capable of achieving c.27.5% efficiency through electricity generation only. Technology supply companies continue to work on increasing this efficiency to c.30%. As such they are often able to achieve R1 (Recovery) status on an electricity only operating mode.

Availability
EfW facilities can achieve 8000 hours per year or greater. Some EfW technology providers will guarantee in excess of 8000 hours.

Capex and Opex certainty
EfW technology supply companies are able to provide certainty about Capex and Opex costs.

Environmental performance
EfW facilities are able to meet all modern environmental emission limits. They can also be retrofitted with additional equipment if these emission limits change in the future.

Ability to process a wide range of waste materials
EfW facilities can process a wide range of input waste materials. They are also able to adapt to changing waste input composition. Waste composition continues to change in the UK as recycling and recovery rates continue to increase and consumer habits change. They can be retrofitted with different equipment, such as water cooled grates, to cope with higher CV waste composition.

CHP enabled
All modern EfW facilities have the capability to be CHP enabled. In the UK finding suitable heat off takers is difficult and therefore the majority of EfW facilities tend to operate in an electricity only generating mode. However, there is growing interest within local authorities in developing ESCOs (Energy Supply Companies) and some of the UK EfW facilities are now being connected into district heating schemes.

Advanced Thermal Treatment (ATT)
There has been significant interest in the UK in ATT technology over the last 10 years.

This has been largely driven by:
(i) the availability of government subsidies in the form of ROCs and CFDs; and (ii) the ability to obtain planning permission for ATT facilities often more easily than for EfW incineration projects. However, ATT development to date (from planning into operational mode) has had limited success in the UK. The key reasons for this include:

Robustness of proposed Technology
In many cases developers have been unable to demonstrate that the technology proposed is suitably robust and is able to process inhomogeneous waste both from residual MSW and I&C waste streams. Many ATT facilities elsewhere are operating only on biomass which is significantly more homogeneous than residual waste.

Gate Fees

Developers have often been unable to offer a competitive gate fee particularly after taking into account the fuel preparation costs to prepare a suitable RDF for processing in the ATT facility. Fuel preparation costs can often add c.£15-25 per tonne onto the "headline" gate fee.

The export of RDF has also had a negative impact on the ATT market development. There were many developers who based their initial financial modelling for ATT projects on their ability to beat landfill costs by £5 or £10 per tonne, which is no longer a competitive position.

Funding

Many developers have failed to raise project finance by not being able to satisfy key Project Funding requirements such as:

- evidence that the technology is able to operate using the proposed waste input;
- evidence that the technology has been operating successfully for at least 8000 hours in any one year;
- provision of a suitable technology EPC (Engineer Procure Construct) wrap;
- evidence that the developer has secured long term waste input contracts; and
- evidence that the developer has secured ROCs/ CFDs

It should be noted that the change from the ROCs to the CFD regime has introduced additional uncertainty into the ATT market place.

Fuel Supply Agreements (FSAs)

Developers have often been unable to source suitable waste tonnages for suitable contract periods. Many ATT developers have targeted residual I&C waste for their fuel. I&C waste is normally contracted for short periods with waste producers and therefore there is a mis-match between the length of contract between the waste producer and the waste company and the length of the contract that the developer requires in order to raise project finance.

Fuel Specification

The specification of the fuel required to be processed in an ATT facility is often onerous. The fuel specification for an ATT facility will often include the following parameters:

- max. shred size;
- max. moisture content;
- min. CV (and sometimes a CV range);
- max. ash content;
- max. metals content; and
- high biomass content

In many cases developers have also sought to include penalties for not meeting the fuel specification within their draft Fuel Supply Agreement. This can make fuel suppliers nervous as the FSA is no longer a simple "Supply or Pay" arrangement with limited liability.

There have been a number of instances where the input fuel requirement has also included a biomass content in excess of 60%. The biomass trend in the UK is for decreasing biomass content within residual waste streams as increasingly more organic waste is being extracted for processing in composting and AD facilities.

Efficiency of ATT facilities

There has been little debate to date about the efficiency of the various ATT technologies operating in an electricity only mode. There is no reason to think that the exploitation of heat/steam in the UK will continue to be anything other than difficult. It remains to be seen whether some ATT technology providers will be able to achieve R1 status in an electricity only operating mode.

Mechanical Biological Treatment (MBT)

Ten years ago many commentators thought that MBT was an alternative to EfW as a "final" solution. However, there is now a general acceptance that MBT is a pre-treatment process and, in order to meet, inter alia, the requirements of the Landfill Directive for residual MSW, the RDF/SRF outputs from many MBT processes have to be thermally treated. Up to 60% of the waste that MBT facilities can process may still require further treatment. There has also been confusion about the effectiveness of MBT technology in meeting the biodegradeability reduction requirements of the Landfill Directive for Municipal Waste. It is now recognised that many MBT facilities do not significantly reduce the biodegradeability of the incoming waste.

Biffa believes that there will be few, if any, additional MBT facilities constructed in the UK after current facilities still in build have been finished.

Autoclave

Autoclave technology was seen as a means of separating potentially valuable recyclate from mixed residual waste streams thus avoiding the need to undertake sorting/segregation in dirty MRFs. It was also seen as a technology to avoid having to construct EfW facilities and could therefore obtain planning permission much easier.

Batch processing

Autoclave technology operates on the basis of a "chamber" being loaded which is then subjected to heat, pressure and agitation. Processes that depend on batch feeding (such as autoclave technology) have relatively high waste handling costs both at the input and output ends of the process. They therefore tend to require high value waste inputs and are thus not financially compatible with the lower value waste inputs predominantly associated with both residual MSW and residual I&C waste streams.

Energy requirements

The energy requirements for autoclaves can also be high and are not compensated by the value of the recyclate output recovered even though these are usually very clean. In addition, there is now less recyclate currently remaining in residual waste streams due to improved segregation through better collection regimes and differential waste collection charging schemes. Therefore the total value of any recyclate recovered will decrease.

Other outputs

The other main output from autoclaves is a floc like substance. Although there was talk about this material being used as an insulation material this was never successfully exploited. The other forms of disposal therefore required result in the overall autoclave process being more expensive than originally modelled.

Cement industry

Energy costs

It is estimated that c.40% of the cost of producing a bag of cement is energy. All of the major cement companies in the UK have therefore been investigating the use of alternative fuels in order to substitute for more expensive virgin fossil fuels such as coal.

Cement production/supply

Cement is now a world wide resource and is controlled by a small number of large cement companies. This means that cement can be imported into the UK from other parts of the world if it is cheaper to do so. It also means that plants in the UK can be closed/mothballed for periods of time. This has a direct relationship on the size of the market for alternative fuels (and cement grade SRF) for the UK cement kilns.

Cement companies in the UK

There are currently 10-11 cement production plants in the UK which process alternative fuels.

The main cement companies in the UK are:

- Cemex
- Heidelberg (Hanson in the UK)
- Lafarge
- Tarmac
- Hope

Cement production plants are usually located close to their principle raw ingredient ie limestone and are thus located in particular parts of the country. This can also have an impact on the transportation costs

associated with moving cement grade SRF to them for processing.

Alternative Fuels

The alternative fuels that the UK cement kilns currently process - include:

- tyres/tyre crumb;
- sewage sludge pellets;
- wood chips;
- MBM (Meat and Bone Meal);
- liquid waste fuels; and
- cement grade SRF

Cement grade SRF specification

SRF for use in cement kilns has to meet specific characteristics - including:

- Moisture content - usually less than 20%;
- CV - usually greater than 17MJ/Kg;
- Chlorine - usually less than 0.8%; and
- Shred size - usually no greater than 30mm

This means that the production of SRF, to this specification, can be relatively expensive. This production expense has to be weighed against the resultant lower gate fee to be paid for the supply of cement grade SRF compared with that charged for “coarse grade” RDF or higher specification RDF for ATT facilities. A number of companies have established exclusive arrangements with particular cement companies in the UK.

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