
Green Investment Bank

The UK residual waste market

A market report by the UK Green Investment Bank
July 2014

Contents

Introduction	3
Executive summary	4
The existing landscape	7
The treatment capacity	10
Suitable waste arisings	
Waste recycling	
Residual waste	
Pre-treatment: 'Dirty' MRFs and MBT	
Waste exports	
Energy from waste treatment – existing facilities	
The merchant waste investment opportunity	
Conclusion	21
Appendix	22
Definitions	
Glossary of terms	
Further information	23
Contacts	

Introduction

This report has been produced by the UK Green Investment Bank in partnership with Tolvik Consulting and is aimed at waste investors and at anyone with an interest in the UK waste market.

The purpose of the report is to set out the investment opportunity in the UK waste market with a particular focus on the current shift to processing commercial and industrial (C&I) waste. The UK Green Investment Bank (GIB) has commissioned Tolvik Consulting (Tolvik) to independently review the market and assess the factors which will impact future energy from waste capacity and waste availability.

This report has been produced by the GIB and Tolvik independently from Government. Its findings therefore should not be viewed as official estimates.

GIB began operations in November 2012. Created by the UK Government and capitalised with £3.8 billion of public money, GIB's mission is to help the UK transition to a greener economy by supporting projects that are both green and commercial.

One of GIB's priority areas for investment is energy from waste, where it has established a track record of activity. GIB can provide the full spectrum of financing across debt and equity with the ability to fund long term projects. It has a dedicated team of waste project finance experts set-up to work with private and public sector organisations and co-investors.

Tolvik is a specialist provider of commercial consultancy and market analysis services to the waste and biomass sectors with a wide range of clients including project developers, waste companies, investors and the public sector. All sources are Tolvik unless otherwise stated.

Executive summary

The UK produced more than 85 million tonnes of waste in 2012, 20.9 million tonnes of which went to landfill¹. As well as being damaging to the environment this is a loss of a valuable resource.

Waste management is critical to the UK and where economically viable our residual waste (i.e. post-recycling waste suitable for energy recovery) can be turned into energy. The UK waste management industry is well aware of the scale of this opportunity and driven by EU targets has made significant improvements to our national waste management programme over the past decade. Since 2000, the amount of waste sent to landfill has dropped by 70% from 70 million tonnes to 20.9 million tonnes and on average household waste recycling rates have risen from 18% to 44%. This is clearly a substantial step in the right direction but with a large amount of waste still going to landfill, there remains a sizeable opportunity for the UK to do more. This is clear when we compare how the UK ranks versus the rest of Europe – see table overleaf.

85m tonnes of waste produced in the UK in 2012

nearly 21m tonnes of which went to landfill

Waste hierarchy



Landfill should be a last resort



Waste should be recycled



What can't be recycled could be turned into energy

The UK is getting better

70% drop in waste sent to landfill | **26%** increase in recycling since 2000

£5bn potential investment opportunity

in energy recovery – to deal with the waste left after recycling

This could create up to **6,000** new jobs and enough renewable electricity to power



6,000 new jobs

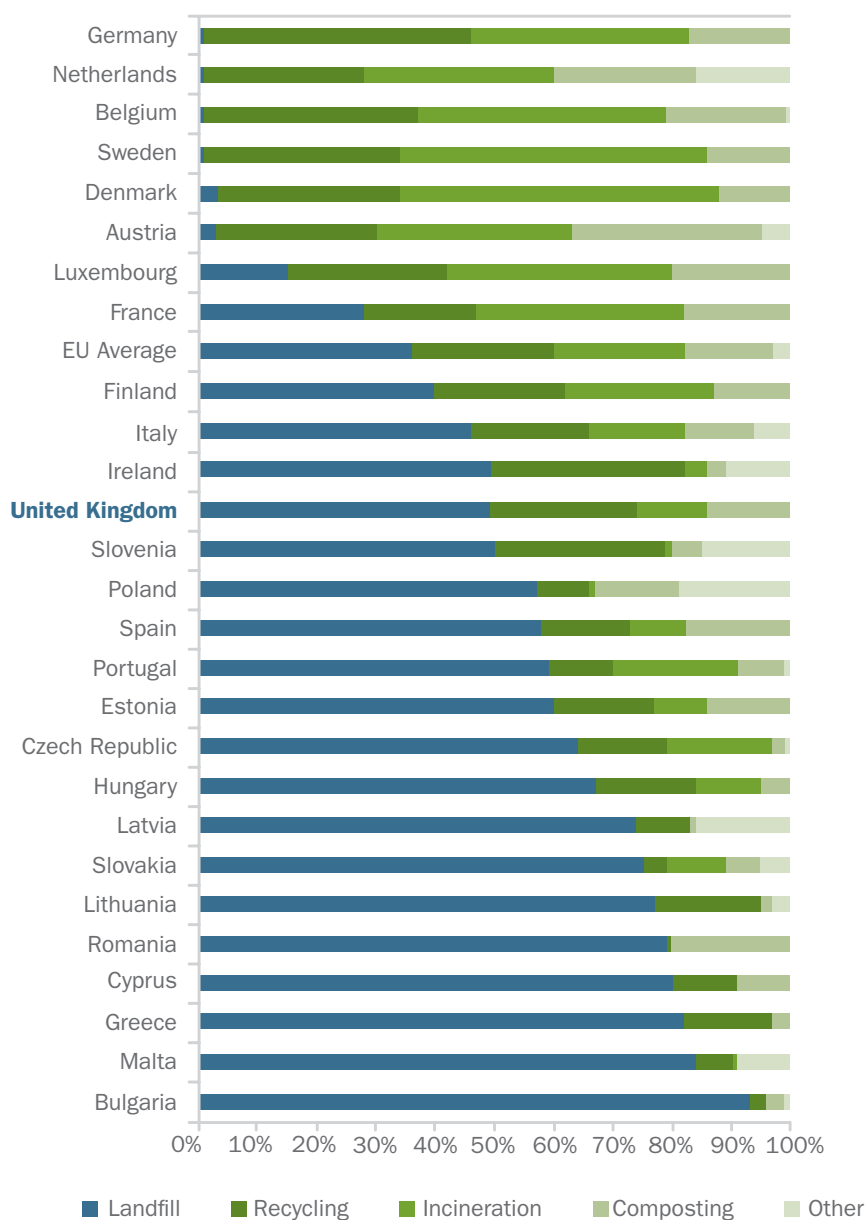


The equivalent of the electricity requirements of Liverpool and Bristol

¹ The 85 million tonnes are the 2012 total waste arisings (i.e. non-hazardous household and C&I waste). Tolvik estimated that 26.4 million tonnes of this waste went to landfill in 2012 (Sources: Environment Agency and Scottish Environmental Protection Agency) of which 5.5Mt were unsuitable waste.

With most of household waste in the UK already being managed through Public Private Partnerships (PPP), some investors are sceptical that there is enough waste remaining to justify building new infrastructure. This report demonstrates that as the market evolves there will remain a gap between the tonnages of residual waste (particularly merchant C&I waste) which are not yet being fully utilised and the energy recovery infrastructure projected to be installed by 2020.

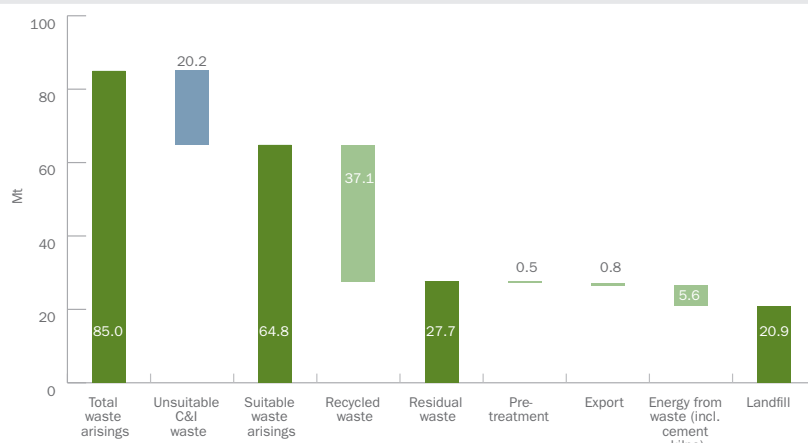
UK waste management versus other European countries (Source: Eurostat, 2011)



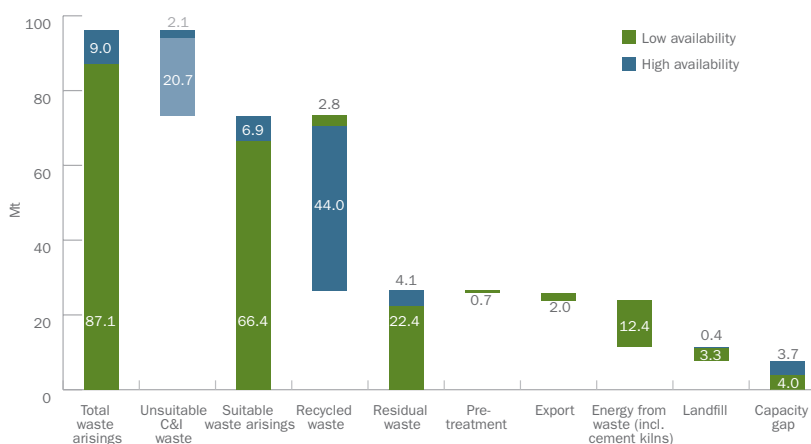
With forecast investment returns higher than many other renewable energy sectors, GIB views the C&I waste market as an attractive and investible asset class – albeit a challenging one due to being at an earlier stage of its development. GIB has and will continue to provide capital to help get new projects built, with the aim of crowding in additional investment from the private sector. Our analysis shows that the identified treatment capacity could translate into an investment opportunity of approximately £5 billion for energy recovery infrastructure (including Advanced Combustion Treatment (ACT) technologies), with an emphasis on processing C&I waste. This could equate to at least ten new energy recovery facilities being built each year until 2020 which is equivalent to an annual investment of >£800 million into new energy technology. This infrastructure could produce electricity equivalent to the needs of nearly 1 million homes (the equivalent of the electricity requirements of Liverpool and Bristol), create around 1,000 long term jobs and up to 6,000 jobs at peak of construction.

GIB can play a limited but important role in structuring and mobilising capital into this potential merchant C&I waste infrastructure market, however the engagement of other waste sector participants is critical.

UK waste landscape in 2012



UK waste landscape in 2020² (Low and high availability cases)



² The 4.0Mt and 7.7Mt treatment capacity evidenced in the low and high availability cases translate into a c. £3 billion-£6 billion investment opportunity on the basis of Tolvik's estimate of an average capital expenditure of £750/t of capacity. The range increases to £3.5 billion-£6.5 billion when adding the £0.5 billion of investment still required for the local authority backed energy from waste infrastructure, of which we assume the mid-point i.e. £5 billion. Please refer to p.19 for further details.

The existing landscape

The waste hierarchy is at the core of the UK Government's waste policy. Priority is given to waste prevention, re-use and recycling/composting. For the waste which remains, energy recovery is generally preferable to disposal to landfill and the UK Government's position is that energy from waste has a value for money role in reducing or mitigating the environmental impacts of waste management. The UK Government is still working towards the 2020 EU targets and is not planning to amend its waste policy outwith the process of negotiating future EU targets.

The UK is getting better at managing its waste in accordance with the waste hierarchy. This has been due to a number of factors but the introductions of the landfill tax and the Landfill Directive have both played key roles. In particular, the £80/tonne landfill tax since April 2014³ means that there is now a considerable economic disincentive to landfilling waste. It has in turn encouraged recycling and made energy from waste facilities more attractive by increasing the competitiveness of gate fees⁴.

As a result, the total volume of residual waste sent to landfill has fallen by 32% in four years to 20.9 million tonnes in 2012 and household waste recycling rates have risen from 18% to 44% in under a decade. £3.5 billion of new energy from waste infrastructure is currently under construction (much of it procured by local authorities as part of PPP projects) suggesting further significant reductions in the tonnages of waste sent to landfill as they become operational.

While performance on recycling and reducing waste sent to landfill is improving, the UK is still significantly lagging behind other European countries and GIB believes that a lot more could be done. However, the potential to do more with our waste comes at a time when the UK waste market is also fast approaching a critical and potentially challenging transition – the shift from new infrastructure processing household waste to those focusing on C&I waste.

With Central Government support for local authority projects no longer available and with a large proportion of household waste either committed to long term contracts or currently in the latter stages of procurement under PPP contracts, investor focus is turning to merchant facilities predominantly processing C&I waste. These merchant facilities do not offer the same security of supply as long term waste contracts with local authorities and are typically dependent upon some element of variable market pricing and generally greater market risk. This has caused some concern among the investment community, leading to a number of project delays and some projects failing to reach financial close.

At the same time, the Government's support for new ACTs⁵ means that the UK has become an internationally appealing market for the development of energy from waste projects using newer gasification and/or pyrolysis technologies. As a result, a number of merchant ACT projects are now coming to market. For investors (including GIB), looking to provide capital, understanding the future size and shape of the UK waste market is a vital element in assessing the overall risk/reward profile of these projects as well as the expected green benefits that they may provide.

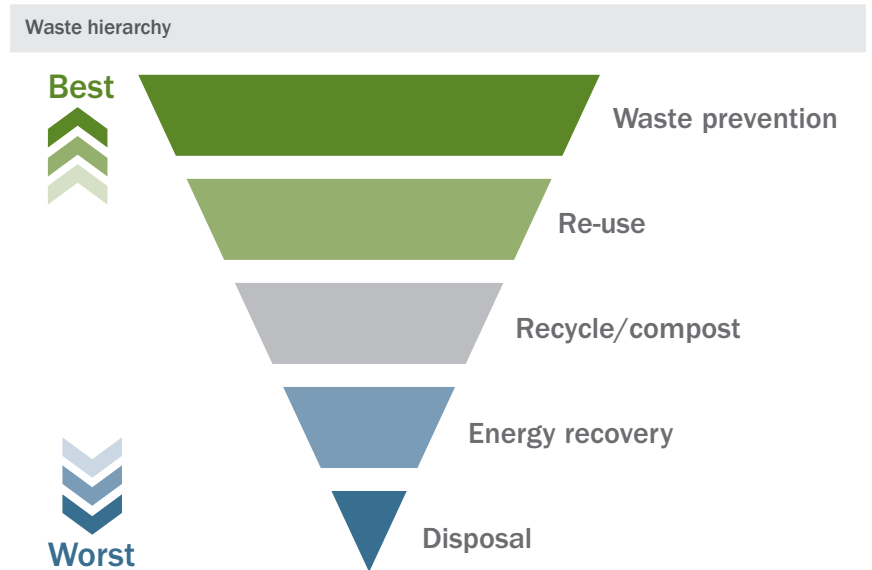
³ To be indexed to the Retail Price Index from April 2015.

⁴ Gate fees are paid to energy from waste facilities for a given quantity of waste received.

⁵ New ACT qualify for ROCs and CfDs.

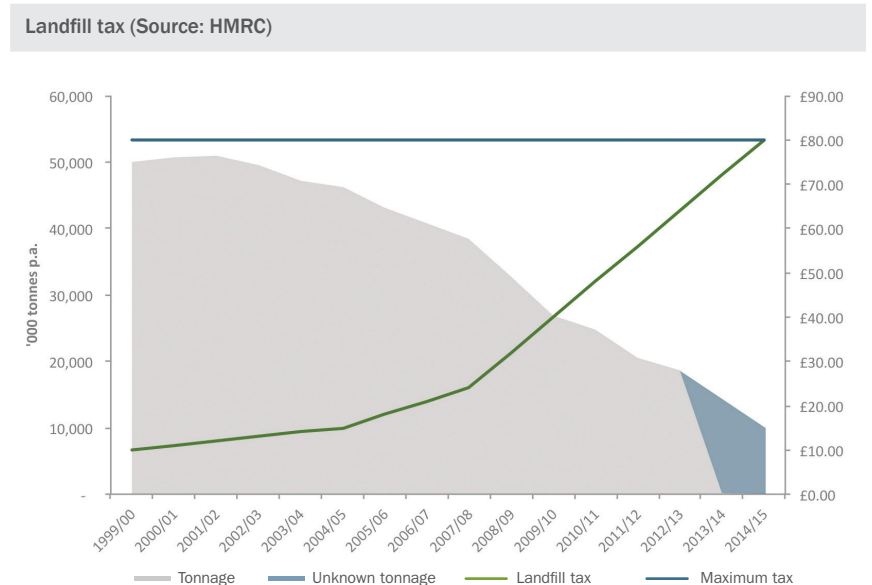
Key Government regulations

- **Landfill directive** – reduce residual biodegradable municipal waste sent to landfill by 65% (from 1995 levels) in 2019/2020
- **Landfill tax** – £80/t since April 2014 to be indexed to the Retail Price Index from April 2015
- **Revised Waste Framework Directive (rWFD)** – Recycle/reuse 50% of household waste by 2020
- **Packaging directive**
- **Zero waste plans in Scotland and Wales**
- **Waste prevention programme for England** – sets out the roles and actions for government and others to reduce the amount of waste produced in England



Landfill tax (Source: HMRC)

- There is a significant cost to managing your waste
- **Landfill tax** equates £80/tonne since April 2014 and will be indexed to the Retail Price Index from April 2015



Green benefits of energy from waste facilities

Energy from waste infrastructure (including ACT) offers a range of environmental benefits which derive from pushing waste further up the waste hierarchy and avoiding the generally more environmentally harmful option of landfill, as follows:

- **Protection of the natural environment and biodiversity:** Landfill sites may cause local nuisance due to unpleasant odours and risk negatively impacting local soil and water quality from leachate. They can also disrupt local biodiversity by causing a proliferation of vermin and flies. Energy from waste facilities significantly reduce environmental harms, provided they comply with strict national and local limits on flue stack emissions, which ensure air pollution is negligible.
- **Greenhouse gas savings:** Energy from waste facilities typically save up to 200 kg CO₂e per tonne waste⁹ on a lifecycle basis compared to landfill by both avoiding landfill's harmful methane leakage and displacing fossil fuels by producing exportable electricity and heat. The exact saving is influenced by a number of factors, including the efficiency of the plant, the nature of the waste and the extent of materials recycling.
- **Advancement of resource efficiency:** A key benefit of energy from waste facilities is the recovery of useful energy which would otherwise be lost. A typical high efficiency energy from waste facility can generate ~700 kWh electricity per tonne of waste⁶. This means that, based on current levels, the residual waste produced by a typical UK household can provide nearly 10%⁷ of its electricity needs – about the same as a typical home's lighting needs⁸. Conventional thermal treatment and ACTs can also be combined with upfront recycling and recovery of metals from bottom ash and provide additional benefit in preparation of the fuel.
- **Advancement of environmental sustainability:** Today's ACTs are developing technologies that offer the potential for increased efficiency for electricity generation if the syngas is used to fuel a dedicated gas engine. The syngas could also be converted to liquid hydrocarbon form for use as a biofuel, which can help displace carbon intensive fuels such as jet fuel.

Provided that energy from waste facilities process only genuinely residual waste as a feedstock and are carefully sized to avoid competition with local recycling efforts, then there is a clear environmental benefit compared to landfill for most materials.

⁶ Based on average anticipated performance of GIB's portfolio of 3 new conventional energy from waste plants.

⁷ Based on waste arisings of 0.43t per person and 2.37 people per household (source ONS 2013) and average annual power consumption per household of 4160 kWh (DECC Energy Trends, March 2013).

⁸ Energy Consumption in the UK (ECUK) Domestic data tables 2013 update table 3.11 estimates lighting at 11% of a typical home's energy needs. Washing, drying and dishwashing is also estimated at 11%.

⁹ Based on anticipated performance of GIB's portfolio of three conventional energy from waste plants.

The treatment capacity

In order to project the 2020 merchant waste treatment capacity, we have modelled a low and high case scenario to estimate the total waste arisings in the UK that will potentially be available by 2020 and similarly made assumptions on recycling rates to 2020¹⁰.

From this, there is a quantity of residual waste remaining which then needs to be handled in one of, or a combination of, the following four ways:

- 1. pre-treatment ('Dirty' Material Recovery Facility (MRF)/Mechanical Biological Treatment (MBT));
- 2. export;
- 3. energy from waste treatment; or
- 4. landfill.

We have also analysed each of these and made assumptions in order to estimate how much future treatment infrastructure will be available by 2020 in order to deal with the forecasted residual waste.

GIB believes that 4.0-7.7 million tonnes of merchant capacity (particularly from C&I sources) could be justified by 2020 based on the low and high case scenarios. This could support new energy from waste treatment infrastructure with a capital value of £3-6 billion¹¹. By taking the mid-point of this range as well as adding the £0.5 billion of investment still required for the local authority backed energy from waste infrastructure highlighted on p.18, we estimate there is likely to be an investment opportunity of £5 billion by 2020 in the UK waste market.



¹⁰ Tolvik assumed that England will recycle 50% of its household waste by 2020.
¹¹ Tolvik note that energy from waste is a long term investment with investment decisions to be influenced by a range of factors post 2020 including inter alia future regulatory developments regarding recycling and waste growth factors.

Suitable waste arisings

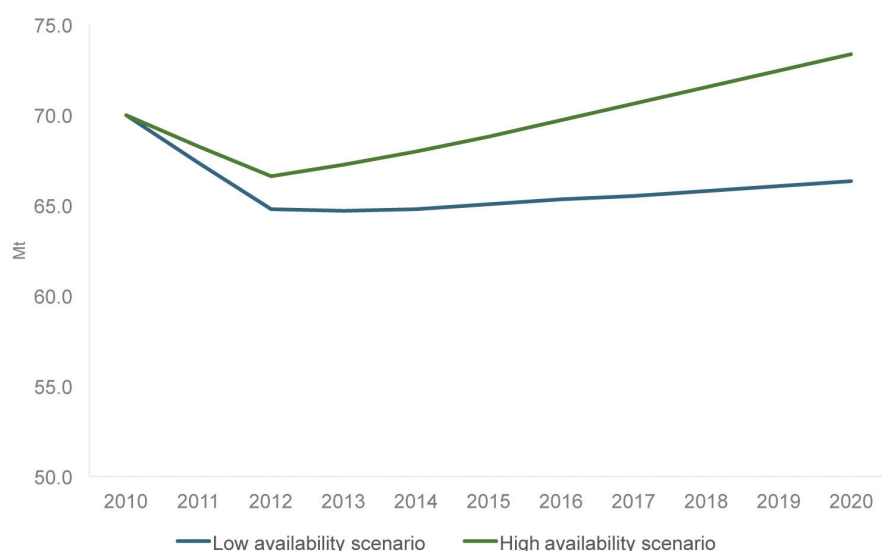
Following recent declines in waste arisings driven by the recession and improved resource efficiency, future economic and population growth is now expected to lead to modest increases in waste arisings. We estimate that suitable waste in the UK totalled 64.8 million tonnes in 2012 (the last year for which data is available) and estimate suitable waste arisings of 66.4-73.3 million tonnes by 2020 based on our low and high availability scenarios.

Future suitable waste arisings will be dependent on a number of factors. Growing populations generally lead to growing volumes of household waste and the Office for National Statistics (ONS) predicts that the number of households is expected to grow over the period to 2020 by just under 1% p.a.¹². There is also a high correlation between increased economic and industrial activity and increased C&I waste and growth in GDP is likely to lead to an increase in total C&I waste arisings, with the latest average medium-term economic growth estimate being 2.2-2.4%¹³.

However, future waste growth may be curtailed due to resource efficiency improvements where businesses (and the wider public) are increasingly aware of the importance of waste reduction and prevention. A recent, high profile example of this has been the noticeable fall in waste generation within the food and grocery sector, in large part driven by the success of the WRAP's Courtauld Commitment¹⁴ initiative to drive a reduction in waste via voluntary industry agreements.

So whilst our analysis suggests that there has been a decline of 7.4% in suitable waste arisings over the last few years, as the global financial recovery starts to take hold, we would expect to see waste volumes increasing accordingly.

Projected suitable waste arisings



¹² <https://www.gov.uk/government/statistical-data-sets/live-tables-on-household-projections> (Table 401).

¹³ HMT: Forecasts for the UK economy: A comparison of independent forecasts. November 2013.

¹⁴ The Courtauld Commitment is a voluntary agreement aimed at improving resource efficiency and reducing waste within the UK grocery sector. The agreement is funded by Westminster, Scottish, Welsh and Northern Ireland governments and delivered by WRAP. It supports the UK Government's policy goal of a 'zero waste economy' and climate change objectives to reduce greenhouse gas emissions. WRAP is responsible for the agreement and works in partnership with leading retailers, brand owners, manufacturers and suppliers who sign up and support the delivery of the targets. It was launched in 2005 and is now in its third phase.

PART 2: THE TREATMENT CAPACITY

The waste growth assumptions used for the two scenarios in this report are:

- **Low availability scenario:** assumes that resource efficiency through to 2020 is strong enough to generally offset waste growth. The net effect would be that suitable waste volumes only rise by 0.3% p.a. on average in the period to 2020.
- **High availability scenario:** assumes that sustained resource efficiency is increasingly challenging and hence less effective in offsetting waste growth. As a result, volumes of suitable waste are assumed to grow by 1.2% p.a. on average.



PART 2: THE TREATMENT CAPACITY

Waste recycling

Household waste recycling rates in the UK have risen dramatically over the last ten years but at c. 44% still significantly lag behind our European peers. We estimate that 37.1 million tonnes of waste was recycled in 2012 and estimate that 44.0-46.8 million tonnes will be recycled by 2020 based on our low and high availability scenarios.

The volume of suitable waste available for energy recovery as residual waste is also dependent on the recycling rate.

As with waste growth assumptions, two recycling scenarios have been adopted:

- **Low availability scenario:** which assumes that the 2020 household waste targets for each of the devolved regions as set out below will be achieved and the 'mixed waste' element¹⁵ of the C&I waste stream follows a similar trend.
- **High availability scenario:** which recognises in the projections the recent slowdown in the rate at which household waste recycling is improving and assumes a similar trend for the C&I waste 'mixed waste'.

In the high availability scenario, we project that an additional 6.9 million tonnes of suitable waste will be recycled by 2020 (rising to 9.7 million tonnes in the low availability scenario). Some of this will be 'at source' recycling, requiring no additional infrastructure investment and some will utilise the spare capacity at existing recycling facilities. However, some of this additional recycling will need to be supported by new recycling infrastructure – be it anaerobic digestion facilities for the treatment of food waste, or specialist facilities for the processing of dry recyclables such as plastics.

Household waste recycling rates and 2020 targets

	Household waste recycling rate	Period	Household waste 2020 targets	Additional detail
England	43.3%	to Jun 13	50.0%	Revised waste framework directive – household waste
Scotland	41.2%	to Dec 12	60.0%	Zero waste plan – household waste
Wales	53.0% ¹⁶	to Sep 13	64.0%	Towards zero waste – municipal waste (statutory)
Northern Ireland	39.7%	to Apr 13	60.0%	2013 consultation – household waste

¹⁵ The Substance Orientated Code (SOC) of Mixed (Ordinary) Waste – i.e. unsorted commercial and industrial wastes.

¹⁶ Municipal waste.

Residual waste

There were 27.7 million tonnes of residual waste in 2012, of which a significant volume was still destined for landfill (c. 75% or 20.9 million tonnes) and could have been more efficiently utilised. We estimate 22.4 million tonnes – 26.5 million tonnes of residual waste will be produced by 2020 based on the low and high availability scenarios.

Residual waste is the suitable waste which remains post recycling and is made up of three main waste streams of varying calorific value, moisture content and composition: untreated mixed/“black bag” waste; Refuse Derived Fuel (RDF) and Solid Recovered Fuel (SRF). The boundaries between these different waste streams can be blurred and this report therefore does not seek to analyse them separately.

Residual waste may be subject to four main treatments which are described more fully in the following sections:

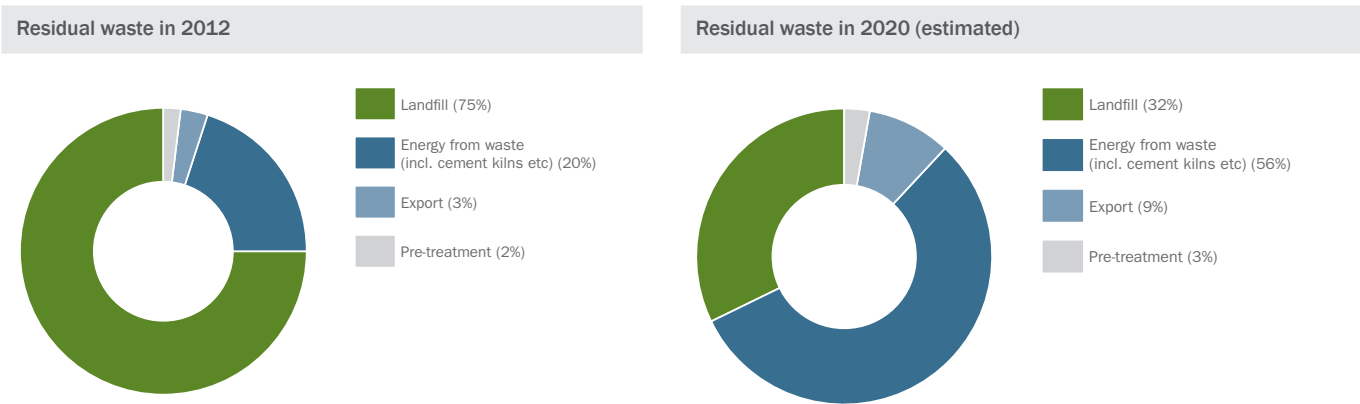
- pre-treatment;
- export;
- energy from waste facilities; and
- landfill.

In 2012, landfill was clearly the predominant waste management option with 75% of the 27.7 million tonnes of residual waste being landfilled (20.9 million tonnes)¹⁷.

Of the remaining, our analysis suggests that 19% was sent to energy from waste facilities (5.3 million tonnes) with all of these facilities being supported, to a lesser or greater extent, by local authority feedstock supply contracts. The balance of 6% comprised export markets (3% or 0.8 million tonnes), mass reduction achieved at MBT facilities (2% or 0.5 million tonnes) and cement kilns and other co-incineration facilities in the UK (c. 1% or 0.3 million tonnes).

The next critical question is therefore to assess how this treatment mix for residual waste could change over the next six years.

Residual waste



¹⁷ Source: Tolvik. Tolvik estimated that 26.4 million tonnes of household and C&I waste went to landfill in 2012 (Sources: Environment Agency and Scottish Environmental Protection Agency) of which 5.5Mt were unsuitable waste.

PART 2: THE TREATMENT CAPACITY

Pre-treatment: 'Dirty' MRFs and MBT

UK MBT capacity is currently 2.4 million tonnes and it is estimated that with the build out of existing local authority backed projects total capacity will reach 3.6 million tonnes by 2020.

Pre-treatment is a physical, thermal, chemical or biological process which can include sorting or altering the characteristics of the waste in order to reduce its volume and/or its hazardous nature and improve its potential for energy recovery. It is important to avoid 'double counting' when analysing pre-treatment facilities – either of waste which is processed at more than one facility or of facilities which are part of a wider supply chain.

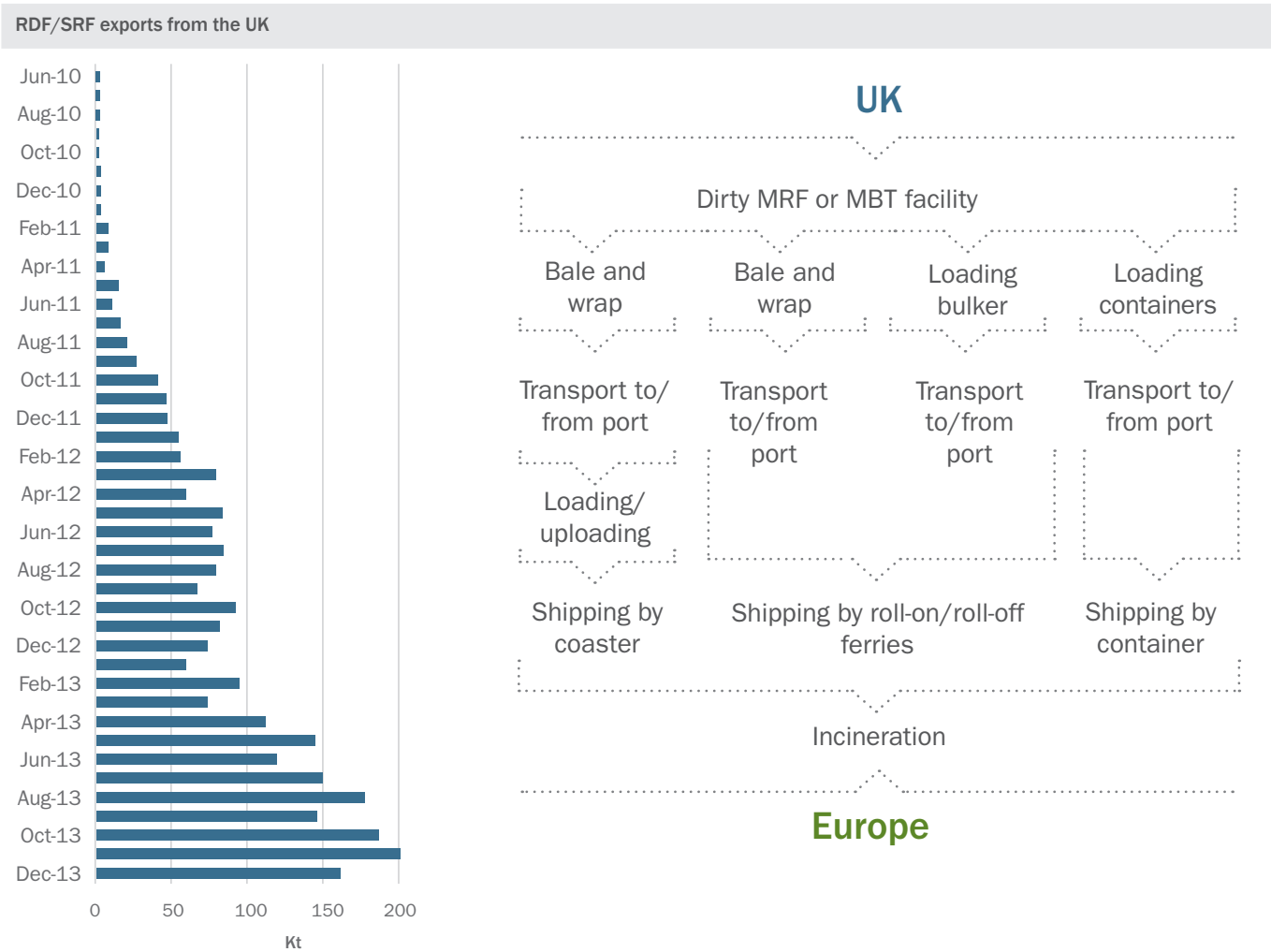
For example, where a 'Dirty' MRF (the name given to a facility which accepts any residual waste rather than only mixed recyclables) accepts waste for recycling, it is assumed that the processing is entirely mechanical, and the outputs either 'count' towards the improved recycling rates described earlier or are residual waste in one form or another. Thus 'Dirty MRFs' are not explicitly included in assessing the supply/capacity balance.

MBT facilities are different in that they also have a biological treatment stage which typically reduces the mass of the incoming waste. Based on typical performance for 'bio-drying' facilities, our review assumes that MBTs will reduce the mass of incoming residual waste by c. 20% or 0.7 million tonnes by 2020. As with the 'Dirty' MRF, the recycling element of MBTs is assumed to 'count' towards the recycling targets.

Waste exports

Europe is increasingly becoming an open and price competitive market for UK waste and will remain a critical determinant on UK gate fees in the near term. The export market in 2012 represented 0.8 million tonnes and we assume an export market of 2.0 million tonnes by 2020.

There has been a rapid growth over the last few years in the export of RDF/SRF from the UK to Europe. In 2012, total exports were just under 1 million tonnes¹⁸ whilst provisional figures for 2013¹⁹ suggest that this figure has increased to 1.6 million tonnes. We have assumed that 2.0 million tonnes p.a. of RDF/SRF will be exported from 2015 to 2020. However, this is used for illustrative purposes as there is no meaningful way by which future export levels can be appropriately quantified. SITA, one of the leading exporters, recently projected²⁰ that the figure would rise to 2.0 million tonnes p.a. in 2015 but fall to 1.0 million tonnes by 2020.



¹⁸ Environment Agency, 2012.
¹⁹ <http://www.letsrecycle.com/news/latest-news/energy/rdf-exports-top-1.5m-tonnes-in-2013>
²⁰ SITA: Mind the Gap. February 2014.

PART 2: THE TREATMENT CAPACITY

The RDF export market is driven by commercial considerations: a combination of both gate fees at the European energy from waste facilities and the costs associated with fuel preparation/logistics. The supply chain has had to expand rapidly over the last few years and there are a number of different 'routes to market' currently being used. As the market develops, exporters can be expected to further reduce these logistics costs, although we note that the availability of back-haul or 'reverse logistics' opportunities, particularly for the shipping of baled RDF by curtain-sider lorries on roll-on/roll-off ferries may remain a key constraint.

Significant over-capacity of energy from waste facilities remains in Europe – particularly in Netherlands, Germany and Sweden. In 2011, it was estimated²¹ that total capacity in these three countries exceeded domestic supply by 5.9 million tonnes. More recent analysis (including that from Sweden²²) suggests that with declining populations in Netherlands and Germany and further improvements in recycling, this figure could grow and by 2020, assuming no decommissioning, may be as much as 8.0 million tonnes.

Whether some of this European spare capacity will be taken by other EU member states remains to be seen but in the UK, the relatively limited current domestic energy from waste capacity, rising landfill tax and the increasingly efficient waste supply chains to Europe mean that the export of residual waste (in the form of RDF and SRF) is and is likely to remain a commercially attractive option for the UK waste industry. As such, the export market will continue to drive the competitiveness of treatment options in the UK and as a result, will remain a key determinant of UK residual waste gate fees in the near term.

Lowest estimated non-spot RDF export cost

Low grade RDF export costs: from London and South East		Dutch portside	Germany inland	Sweden coastal
Wrapping/baling	CIWM report ²³	5.00	5.00	5.00
UK road transport	Estimated	5.00 – 10.00	5.00 – 10.00	5.00 – 10.00
Admin/port costs	CIWM report	5.00	5.00	5.00
Sea transport costs	CIWM report	5.00	5.00	10.00
Europe road transport	Port side location onwards	0.00	15.00	10.00
Energy from waste gate fee		45.00	35.00	30.00
Total (£ Cost/t)		65.00-70.00	70.00-75.00	65.00-70.00

²¹ Tolvik: UK Waste Exports – Opportunity or Threat? June 2011

²² Avfall Sverige: Assessment of increased trade of combustible waste in the EU. April 2012

²³ Ricardo AEA/CIWM: Commercial and Industrial Waste in the UK and Republic of Ireland. October 2013

PART 2: THE TREATMENT CAPACITY

Energy from waste treatment – existing facilities

There are 5.2 million tonnes of existing energy from waste facilities currently operating in the UK and we estimate this will reach 11.9 million tonnes by 2020.

The local authority waste PPP procurement programme in the UK is nearing conclusion²⁴ and there is now significant energy from waste capacity focussed predominantly upon household waste either in construction or for which construction is imminent.

Infrastructure capable of processing a headline capacity of 10.9 million tonnes of waste is either operational or in construction, with a further 1.1 million tonnes for which construction is imminent²⁵. A further 2.3 million tonnes of potential additional capacity has been identified as proposed for development in support of PPP procurements. Not all of this latter capacity is

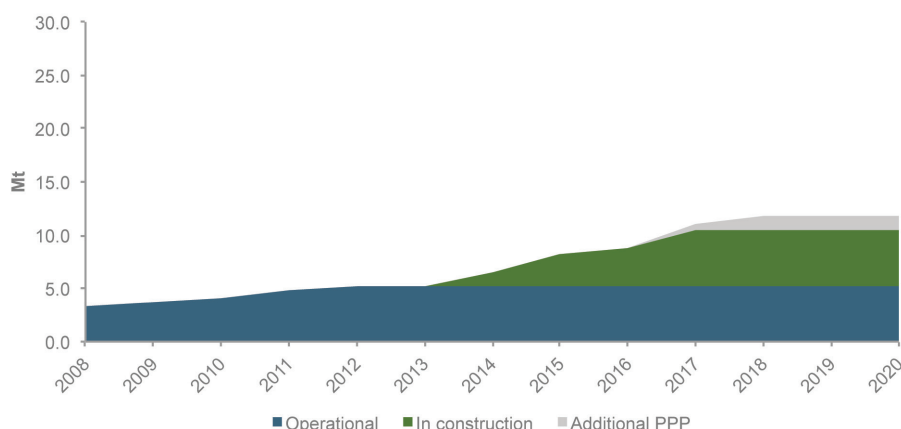
likely to be built and we have assumed a 62% probability of development²⁶. This probability of development reflects more the planning rather than financing risk associated with these projects.

Combining these results, adjusting for assumed availability (energy from waste facilities historically have not operated at 100% of their headline capacity) and assuming that no existing facilities are decommissioned prior to 2020, total energy from waste capacity in the UK is projected to rise to 11.9 million tonnes by 2020, doubling the existing 5.2 million tonnes of operational capacity. We estimate this additional 2.3 million tonnes of potential PPP-backed energy from waste infrastructure will require approximately £1.7 billion²⁷ additional investment by 2020, of which it is estimated £0.5 billion has yet to secure finance.

Projected PPP backed energy from waste capacity (as at December 2013)

Status	Permitted capacity	Assumed availability	Projected capacity	Probability of development	Projected capacity
Operational energy from waste	6.2	86%	5.2	100%	5.2
In construction energy from waste	4.7	90%	4.2	100%	4.2
PPP construction imminent	1.1	90%	1.0	100%	1.0
Additional PPP	2.3	90%	2.0	62%	1.5
Total (million tonnes)	14.3		12.4		11.9

PPP backed energy from waste capacity (as at December 2013)



²⁴ With the removal of PPP credits by local authorities since 2013, there are currently a very limited number of PPP projects in procurement in the UK.

²⁵ This is based on information as at the 31 December 2013 and following a comparison with the data in a recent report prepared for the Chartered Institution of Wastes Management (Ricardo AEA/CIWM: Commercial and Industrial Waste in the UK and Republic of Ireland (October 2013).

²⁶ Tolvik analysed each UK project in procurement and applied the 60% or 70% delivery adjustment rates as set out on page 11 of DEFRA's 'Forecasting 2020 Waste Arisings and Treatment Capacity' (October 2013). The resulting weighted average delivery adjustment rate is 62%.

²⁷ This is based on Tolvik's estimate of an average capital expenditure of £750/t of capacity.

PART 2: THE TREATMENT CAPACITY

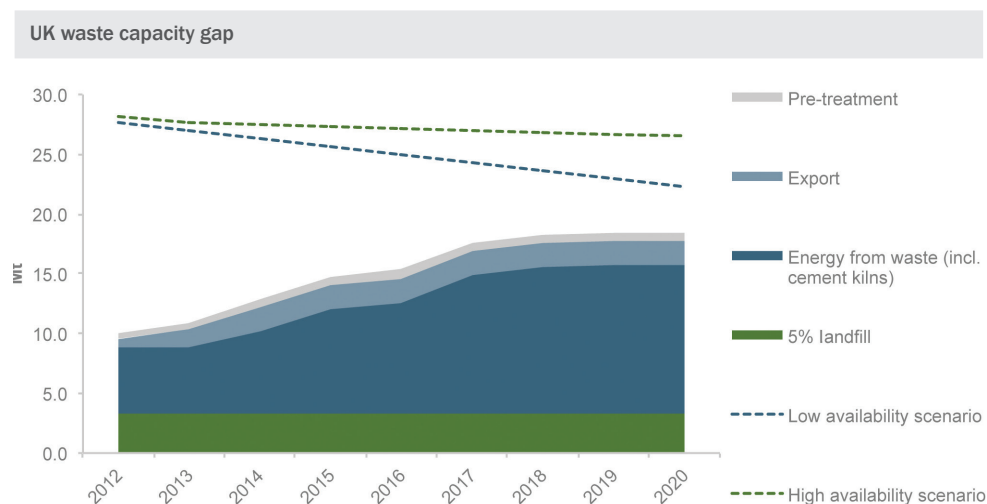
The merchant waste investment opportunity

A need exists for additional infrastructure in the UK, to 2020 and potentially beyond then. We estimate that this is between 4.0 million and 7.7 million tonnes of merchant capacity which represents a potential investment opportunity of approximately £5 billion²⁸.

By comparing the projected 2020 tonnages of residual waste with the available treatment capacity, we estimate that there is scope for new merchant infrastructure which will require approximately £3-£6 billion²⁹ of additional capital investment by 2020. When adding the £0.5 billion of investment still required for the local authority backed energy from waste PPP infrastructure highlighted in the previous section, the additional capital investment required by 2020 increases to £3.5-£6.5 billion, of which we assume the mid-point i.e. £5 billion.

Importantly, it should be noted that this report uses a different methodology from other published reports. Our analysis only considers new facilities planned in response to PPP procurements and excludes all potential new merchant projects from the market review (although it is estimated that there is c. 8.3 million tonnes of merchant energy from waste capacity in the UK which already have planning permission). This allows us to assess the scale of the opportunity to invest in merchant projects without the need to make an assessment as to the 'probability of development' for individual merchant projects.

The result of our analysis is in line with some of the leading waste market participants' recent reports such as SITA³⁰, who also cite the need for an increase in the level of investment into this sector to meet the projected level of available residual waste in 2020 and beyond.



²⁸ The potential £5 billion investment opportunity includes £0.5 billion of investment still required for local authority backed energy from waste infrastructure.

²⁹ On the basis of Tolvik's estimate of an average capital expenditure of £750/t of capacity.

³⁰ The two key differences between SITA and GIB's analysis is that GIB's numbers assume more conservative recycling rates and SITA makes assumptions regarding the development of merchant capacity.

PART 2: THE TREATMENT CAPACITY

This report focuses on the period to 2020. Even in looking forward six years there is considerable uncertainty as to how the waste market may develop. For investors in energy from waste facilities with a design life of 25 years, the variables at play are further magnified – be they waste arising projections, future recycling rates, the development of new capacity. This report is therefore no substitute for project specific analysis.

One of the key risks for GIB associated with energy from waste is that the construction of new capacity could ‘crowd out’ recycling. Tolvik was therefore tasked by GIB to run a sensitivity scenario of 70% household waste recycling rate through its model. The model showed, even at the identified investment levels, and not allowing for any future energy from waste decommissioning, that there would be sufficient waste available (from the 5% modelled as going to landfill and from RDF exports), to meet the modelled energy from waste capacity without having an adverse impact on recycling.

UK waste treatment capacity and resulting investment opportunity by 2020

2020 low and high availability cases (million tonnes)	Low	High
Total suitable waste arisings	66.4	73.3
Recycling	44.0	46.8
Residual waste	22.4	26.5
Pre-treatment	0.7	0.7
Export	2.0	2.0
UK thermal treatment (operational, in construction/PPP procurement)	11.9	11.9
Other (cement kilns etc.)	0.5	0.5
5% ³¹ to landfill	3.3	3.7
Merchant energy from waste treatment capacity	4.0	7.7
Merchant energy from waste investment (billion pound)	£3bn	£6bn

³¹ For illustrative purposes, it has been assumed that if the market is to operate efficiently in both environmental and economic terms, up to 5% of suitable waste will continue to be landfilled. This recognises practical market limitations – e.g. geographic remoteness, seasonal variations in supply, changing waste composition or variations in UK treatment capacity.

Conclusion

Our report provides an assessment of the UK waste market potential and concludes that there is an opportunity to invest approximately £5 billion in UK energy from waste infrastructure, with an emphasis on processing C&I waste. GIB believes the C&I market to be an attractive and investible asset class and will continue to assess opportunities to provide capital to new merchant C&I waste projects.

GIB can play a limited but important role in structuring and mobilising capital into this potential merchant C&I waste infrastructure market, however the engagement of other waste sector participants is critical. We remain very keen to engage with current waste sector participants and with many more investors and operators entering the market over the next few years to ensure its successful development.

Appendix

Definitions

- **Suitable waste:** local authority collected waste (LACW) plus an estimated 63% of the total C&I waste stream which is readily combustible i.e. excluding inert wastes, hazardous wastes and industrial waste streams such as sludges, metals, chemical and mineral wastes. It should be noted that the definition of suitable waste is marginally wider than that for municipal waste used by DEFRA in its 2013 analysis of potential compliance with the Landfill Directive.

For the avoidance of doubt it also excludes the separate waste wood market in which GIB has already made two recent investments – Evermore Renewable Energy and Birmingham BioPower Limited.

- **Recycling:** This includes the separation at source of dry recyclables – paper, cans, plastics, glass etc. – either as separate streams or mixed together ('commingled') with subsequent processing at a 'Clean' Materials Recycling Facility (MRF); the separation at source of organic matter – e.g. food waste for anaerobic digestion, green waste for composting; and the mechanical recovery of dry recyclables from the mixed, black bag waste stream – either at a Mechanical Biological Treatment (MBT) facility or 'Dirty' MRF.
- **Residual waste:** Consistent with the waste hierarchy, the tonnage of suitable waste that remains following recycling which is suitable for energy recovery.
- **PPP:** Long term local authority feedstock contracts focusing on household waste.
- **Merchant:** In which feedstock supply is principally backed by commercial waste producers/operators, with shorter contract period and in which feedstock pricing and/or contracted tonnages are partially determined by market forces

Glossary of terms

Defined term	Meaning
ACT	Advanced Combustion Treatment
C&I waste	Commercial and industrial waste (not collected by local authorities)
CfDs	Contracts for Difference
Energy from waste	For the purposes of this report this relates solely to thermal treatment – incineration, gasification, pyrolysis and excludes anaerobic digestion
GIB	UK Green Investment Bank
MBT	Mechanical Biological Treatment
MRF	Materials Recycling Facility
ONS	Office of National Statistics
PPP	Public Private Partnership
ROCs	Renewable Obligation Certificates
RDF	Refuse Derived Fuel – as a minimum prepared to meet export requirements which prevent the export of mixed municipal waste
SRF	Solid Recovered Fuel – prepared to a specification typically including calorific value, size, moisture content, contaminant levels, ash content etc.

Further information

Contacts

If you would like to get in touch with GIB about a waste or bioenergy project please contact:

Chris Holmes
Managing Director – Waste and Bioenergy
Tel: 0330 123 3041
Email: chris.holmes@greeninvestmentbank.com

Andrew Hartley
Director – Waste and Bioenergy
Tel: 0330 123 3044
Email: andrew.hartley@greeninvestmentbank.com

Stephen Ray
Director – Waste and Bioenergy
Tel: 0330 123 3074
Email: stephen.ray@greeninvestmentbank.com

You can find out more about GIB at www.greeninvestmentbank.com or find us on LinkedIn.

Disclaimer

UK Green Investment Bank plc (the “Company”) is a public limited company which is wholly owned by The Secretary of State for Business, Innovation and Skills. The Company is registered in Scotland with registered number SC424067 and has its registered office at Atria One, Level 7, 144 Morrison Street, Edinburgh EH3 8EX. The Company is not authorised or regulated by the Financial Conduct Authority or the Prudential Regulation Authority. The information in this communication, which does not purport to be comprehensive, has been provided by the Company to you for information only and on the express understanding that you shall use it on a non-reliance basis. This communication has been prepared in good faith, no representation or warranty, express or implied, is or will be made and no responsibility or liability is or will be accepted by the Company or any of the Company's subsidiaries or by any of their respective officers, employees or agents in relation to the accuracy or completeness of the information or any other written or oral information made available to you and any such liability is expressly disclaimed. In particular, but without prejudice to the generality of the foregoing, no representation or warranty is given as to the achievement or reasonableness of any future projections, management estimates, prospects or returns contained in this communication or in such other written or oral information. No information set out or referred to in this communication shall form the basis of any contract. The Company will not act and has not acted as your legal, tax, accounting or investment adviser. This communication does not constitute or form part of any offer or invitation to sell, or any solicitation of any offer to purchase, any investment and the Company does not arrange investments for/introduce parties as a result of sharing the information set out in this communication.

This report is printed on 100% recycled paper.

Headquarters
Atria One, Level 7
144 Morrison Street
Edinburgh EH3 8EX

Tel: +44 (0)330 123 2167
enquiries@greeninvestmentbank.com

London Office
21–24 Millbank Tower
Millbank
London SW1P 4QP

Tel: +44 (0)330 123 3021
www.greeninvestmentbank.com

July 2014
