

Anaerobic Digestion Market Update

Addressing the Feedstock Famine

Contents

- 1.0 Introduction and Study Context 1**
 - 1.1 Impact of Government Incentives for Energy Generation 1
 - 1.2 New Recycling Targets..... 2
 - 1.3 Objectives of the Report 3
- 2.0 Determination of a ‘Capacity Gap’ for AD..... 3**
 - 2.1 Wastes from Food Processing and Manufacturing..... 4
 - 2.2 Household Food Wastes..... 5
 - 2.3 Commercial Food Wastes..... 5
 - 2.4 Forecast Capacity Gap..... 5
- 3.0 Barriers to Greater Capture of Food Wastes 7**
 - 3.1 Wastes from Food Processing and Manufacturing..... 7
 - 3.2 Household Food Wastes..... 8
 - 3.3 Commercial Food Wastes..... 8
- 4.0 Recommendations for ‘Unlocking’ Food Waste 9**
 - 4.1 Potential New Collection Pricing Mechanisms for Commercial Wastes..... 9
 - 4.2 Future Trends towards Collaborative Procurement..... 10
 - 4.3 Better Enforcement of the Waste Hierarchy 10
 - 4.4 Requirement to Sort Commercial (and Household) Wastes 11
- 5.0 Summary of Key Messages 12**
- A.1.0 Appendix 1 - Methodology for Modelling the Capacity Gap 15**

1.0 Introduction and Study Context

This brief report comes at a particularly critical time for the anaerobic digestion (AD) industry. In 2011, the Government's AD Strategy and Action Plan stated an aim *not* to provide targets for new AD infrastructure, but rather to help remove 'obstacles' to development.¹ Eunomia's AD market outlook report in July 2011 highlighted that perhaps the most important obstacle to facility development was gaining access to feedstock under sufficiently attractive terms to secure commercial investment.²

Whilst there has been growth in the number of AD facilities since our last market report, this growth is still being constrained by access to feedstock. There continues to be a vast quantity of food waste *potentially available*, but for a number of reasons a large proportion of this remains (unseparated) within the residual waste stream, and so cannot readily be accessed. In the absence of new policies, or changes to existing ones, there is nothing to suggest that this situation will change fundamentally in the near future.

1.1 Impact of Government Incentives for Energy Generation

Both the small-scale Feed-in Tariff (FiT) and more recently, the Renewable Heat Incentive (RHI) have gone some way to attracting equity investment into the sector, but as pointed out in our 2011 report, the length of contracts in the non-household sectors remain too short to attract debt funding. This is also highlighted in a 2013 study on behalf of the UK Green Investment Bank (GIB), which recognised that 'robust feedstock contracting arrangements' are essential to facilitate raising debt finance.³ The GIB report does not, however, in its estimate of the potential of the AD sector, provide any meaningful analysis of the issue of feedstock availability as a constraint to development.

Whilst the threat of tariff depression exists under both the FiT and RHI, thus far, this has been relatively minor. A further review by the Department for Energy and Climate Change (DECC) of FiT tariffs for AD is, however, due late in 2014, and DECC is also currently consulting on early revisions to the RHI tariff for biomethane to grid injection. Both of these developments, but particularly the latter, are currently creating uncertainty in the market.

In respect of potential FiT depression, it is important to highlight the way in which DECC has based the assessment of whether the market has exceeded capacity

¹ Defra (2011) *Government Review of Waste Policy in England 2011*, June 2011; Defra (2011) *Anaerobic Digestion Strategy and Action Plan - A commitment to increasing energy from waste through Anaerobic Digestion*, June 2011

² Eunomia (2011) *Anaerobic Digestion Market Outlook: Overcoming Constraints to Deliver New Infrastructure*, July 2011. <http://www.eunomia.co.uk/shopimages/Eunomia%20-%20Anaerobic%20Digestion%20Market%20Outlook%20Report.pdf>

³ Green Investment Bank (2013) *Anaerobic Digestion Market Report 2013*, June 2013 www.greeninvestmentbank.com/media/5188/ad-market-report-june-2013.pdf

trigger points (for tariff reductions). This has been based on the level of capacity which has been *pre-accredited* by Ofgem under the FiT. Planning consent, which is one condition of pre-accreditation (alongside an accepted grid connection offer), continues to be relatively easy for AD facilities to gain (compared to some other types of waste treatment plant), but due to feedstock constraints, a significant proportion of the consented capacity which is pre-accredited is very unlikely to reach financial close. During the FiT review, therefore, it will be critical for DECC to more accurately assess both the level and nature of the AD capacity which is in the development pipeline.

The potential changes to levels of support under the FiT or RHI are important in the context of the economics of separate food waste collection and treatment, which is indirectly supported by both mechanisms. The current tariff levels, however, have been insufficient to drive change within much of the commercial waste sector (i.e. catering industries, retail, offices and public sector, e.g. schools, hospitals), and it is therefore upon this sector which much of this report focuses.⁴ As such tariffs appear to be on a downward, rather than upward, trend it is necessary to consider alternative approaches to driving feedstock availability.

1.2 New Recycling Targets

At the time of writing, the European Commission ('the Commission') is poised to publish a Communication to the European Parliament for a proposed package of measures towards achieving the functioning of a 'circular' economy and a programme for zero waste across all European Union (EU) Member States.⁵ On behalf of the Commission, Eunomia has managed the consultation process associated with the development of this Communication.⁶

This Communication is likely to include a range of suggested measures, which may include a legislative proposal, based on a review of the Article 11a target in the Waste Framework Directive (WFD), for a 70% recycling rate by 2030 for municipal solid waste (MSW).⁷ Currently, the definition of municipal waste varies across countries of the EU, but in many it includes not only household, but commercial wastes, whereas in the UK, it has tended to be used only in respect of the former.⁸

⁴ At the same time, both the FiT and RHI have to some extent resulted in a fall in gate fee revenue, which partially offsets that derived from the tariffs

⁵ A circular economy might be defined as one which keeps the value added in products for as long as possible and eliminates waste. It functions by retaining the resources within the economy when a product has reached the end of its life, so that they remain in productive use and create further value

⁶ For further details, see <http://www.wastetargetsreview.eu/section.php/4/1/consultation>

⁷ A Communication from the Commission is usually the first step in development of a related EU Directive

⁸ The term municipal waste is defined in guidance from Eurostat. See http://epp.eurostat.ec.europa.eu/portal/page/portal/waste/key_waste_streams/municipal_waste

If this recycling target does indeed pass into law, the direction of travel of Government policy would need to deliver increasing recycling rates within *both* the household and commercial sectors.⁹ To achieve a rate of 70% would be extremely difficult without targeting food waste, and it therefore appears perfectly possible that this, or a subsequent Government, must give meaningful consideration to some kind of further regulatory measures, such as those discussed in Sections 4.3 and 4.4. In the short term, however, there are commercial and market-driven approaches, which might be adopted by industry to deliver greater captures of food waste, as discussed in Sections 4.1 and 4.2. As noted above, however, our modelling of a capacity gap in Section 2.4 assumes that there is no regulatory change of this nature prior to 2023/24.

1.3 Objectives of the Report

The aims of this report are therefore:

1. To broadly quantify the types of source separated food waste that are potentially available and highlight the current treatment 'capacity gap', i.e. the difference between available food waste and level of capacity.
2. To identify the barriers to separate collection of food waste, particularly from the commercial sector; and
3. To consider and provide recommendations as to how these barriers might be overcome, from both commercial/market and regulatory perspectives.

At the same time, with a focus on ensuring that food waste is managed in line with the food waste hierarchy, it is important to consider the future impacts of increasing prevention and redistribution (i.e. of surplus edible food to humans and livestock) upon feedstock availability.

2.0 Determination of a 'Capacity Gap' for AD

The goal of this analysis is to estimate – in broad terms – how much food waste is *actually available* from the household, commercial and industrial sectors, i.e. how much is currently being captured (and might realistically be captured in future), and how this compares to current and future forecasts of AD capacity for food waste treatment.

Whilst other recent (subscription-based) publications provide detailed data on the capacity and status of AD facilities, along with providing estimates of feedstock arisings, they have neither attempted to forecast the likely roll-out of facilities currently under development nor considered the different types of food waste in any detail. This latter analysis is critical towards identifying where the constraints to market development lie. Similarly, whilst WRAP has undertaken significant work to

⁹ Given that the definition of municipal waste covers both household waste and other similar wastes, irrespective of who actually collects that waste

quantify total food waste *arisings* in different sectors, such estimates have tended not to take into consideration the following:

- The current and likely future (without regulatory change) extent of provision of separate collection systems for both commercial and household wastes;
- Specific to food processing and manufacturing wastes:
 - The attractiveness for AD of feedstocks which have both a low solids content and biogas yield potential;
 - The impacts of the UK Animal By-products Regulation (ABPR), which precludes the treatment by AD of much waste from abattoirs; and
 - The impacts of alternative, often more cost-effective management routes, such as use of fruit and vegetable processing residues as animal feed.
- The potential impacts of ongoing waste prevention or minimisation activities.

Both of these latter two impacts are important, not just in terms of their relative commercial attractiveness, but because of their position in the waste hierarchy above AD.¹⁰

The distinction between actual availability and arisings is critical. Whilst the data available does enable accurate estimates for some waste streams in both respects, for others it is more challenging, and thus assumptions are required to derive sensible estimates suitable for a report of this nature.

Over a range of projects for private and public sector clients, Eunomia has developed, and progressively improved, a methodology for modelling food waste availability across a range of core market sectors. A high level version of these methodologies is presented in Appendix 1. For clarity, the analysis in this report focuses on the quantification of *food wastes* from the household, commercial and food manufacturing/ processing sectors only.

2.1 Wastes from Food Processing and Manufacturing

Our model suggests that the tonnage of food waste which is actually available from the food processing and manufacturing sector will decrease from 1.8 million tonnes in 2013/14 to 1.6 million tonnes in 2023/24. As highlighted above, to a large extent, our analysis includes only food wastes considered suitable for treatment via AD. This projected decrease in available food waste is largely due to the impact of increasing efficiencies in food processing and manufacturing along with the effect of food waste prevention initiatives.

¹⁰ Defra (2011) *Guidance on applying the Waste Hierarchy*, June 2011
<http://www.defra.gov.uk/publications/files/pb13530-waste-hierarchy-guidance.pdf>

2.2 Household Food Wastes

We anticipate that separately collected household food waste will rise significantly from the 0.4 million tonnes collected in 2013/14 to a total of 1.3 million tonnes by 2023/24. This is due to a combination of two factors:

- Primarily, an increase in the number of local authorities collecting food waste from households. Whilst local authority budgets remain tight, we do expect further collection services to be introduced, including those from the 25 authorities which won funding for separate food waste collections from DCLG, following £250 million of funding being allocated to various new collection schemes in 2012; and
- An improvement in the capture rate of food waste from households receiving such collections, as schemes become better implemented and householders become better educated. At the same time we note that household waste prevention initiatives (for example, under the Courtauld Agreement, or 'Love Food, Hate Waste' Campaign) may have reduced 'per household' captures of food waste, but that these effects are not yet clear.

The estimated increase in capture from this sector is based upon the assumption that no new legislative requirements for collecting food waste from households are introduced in the next decade, which might significantly further increase the tonnage of food waste actually available for AD.

2.3 Commercial Food Wastes

Our model for commercial food waste *arising*s suggests an increase from 2.6 million tonnes in 2013/14 to 2.9 million tonnes in 2023/24. This rise is largely due to anticipated growth of the wider commercial sector and thus tonnage food waste which is generated by the market. It is important to highlight here, however, that in contrast to food wastes from the food processing/manufacturing sector, only a small proportion of these arising is believed to be currently separately collected and thus actually available to AD operators. We have assumed, based on our experience of working with both a range of major waste collection contractors and AD operators, that only around 10% of commercial food waste was collected in 2013/14, and that without any change in regulation, this might rise slowly to 15% by 2023/24.¹¹ This is almost exclusively due to the very low levels of collection service provision in this sector, as is explored in more detail in Section 3.3.

2.4 Forecast Capacity Gap

To determine the tonnage of AD capacity (to treat food wastes) which is operational, both now and in the future, we have applied assumptions to each AD facility currently under development. This future deployment profile of new capacity is added to the current baseline capacity. Data on both existing and new facilities is drawn from

¹¹ We recognise, however, that even this increase might be optimistic given the absence of any current related policy drivers

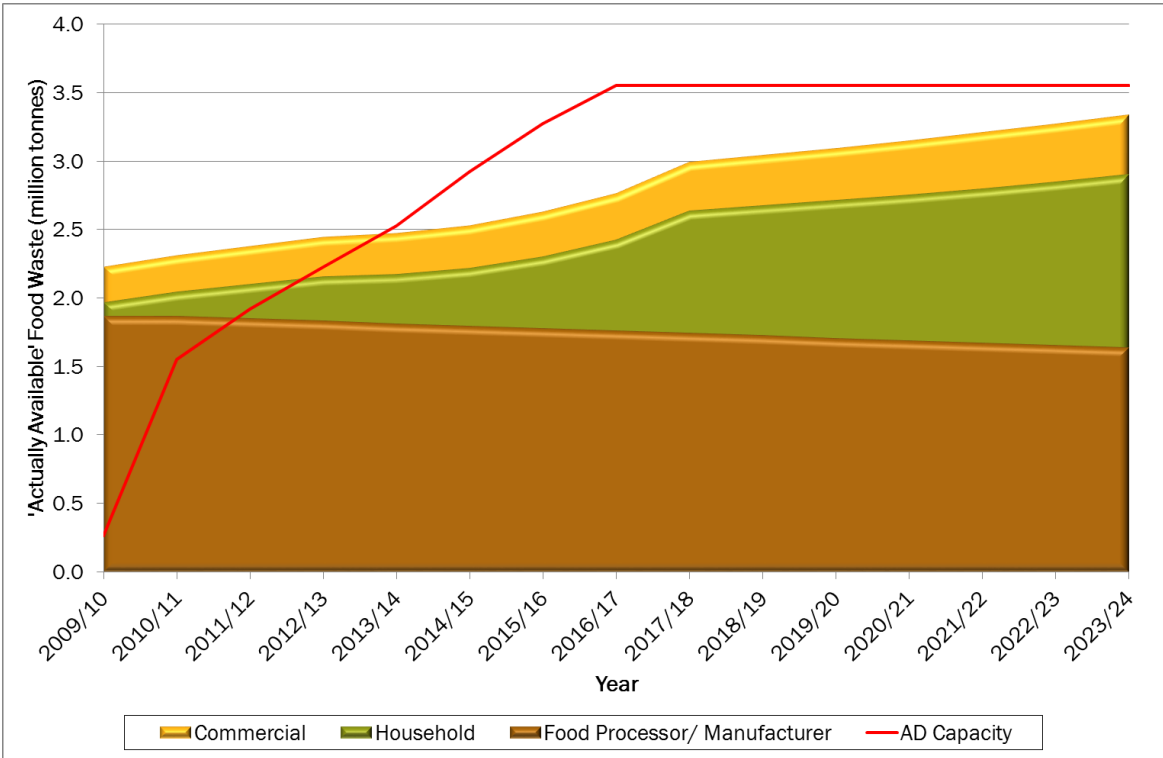
our in-house Waste Treatment Facilities Database. The approach to modelling future capacity is described in more detail in Appendix A.1.4.

This information has been used alongside the forecasts for actual availability of food wastes described in Sections 2.1 to 2.3 to determine an estimated capacity gap to 2023/24. The results of this analysis are presented in Figure 1. This shows that there is currently 2.8 million tonnes of AD capacity designed to treat food wastes from food processing and manufacturing, households and commercial enterprises. It is important to clarify that this excludes any capacity which is designed for processing energy crops, such as maize, or farm wastes, i.e. slurries.¹² Based on our analysis of facilities currently in the development phase, this capacity is projected to increase to 3.5 million tonnes in 2016/17. Beyond 2017, it is likely that only very limited further capacity will come online, albeit it is challenging to forecast beyond the current commercial development timeline.

This capacity forecast suggests that there is already an excess of supply of AD capacity (over and above available food waste) of around 0.1 million tonnes, and that this may increase to excess supply of 0.8 million tonnes in 2016/17, before falling back to 0.2 million tonnes by 2023/24, as captures of food waste grow, but capacity (under our assumptions) remains static. It therefore appears that the market has recently reached a 'tipping point' beyond which there is not currently sufficient feedstock being collected (from the food processing/manufacturing, household and commercial sectors) to support operation of new facilities coming to market. Without any change in the market or regulatory environment to stimulate separate collection of household, and importantly, commercial wastes (recommendations for which are explored in Section 4.0), therefore, we might expect competition for feedstock to be relatively fierce (with local / regional variation in this), and perhaps, some consolidation in the sector in the medium term. This is a situation which is being borne out in our ongoing advisory work for some operators and developers, some of whom are struggling to access sufficient feedstock at a level of gate fee which can support either new plant development or ongoing operation, let alone long-term commercial viability.

¹² Albeit it should be recognised that in the current market, operators of some facilities which have been designed to process food wastes are considering such alternative feedstocks as part of efforts to maintain high throughput and maximise biogas yield

Figure 1: Capacity Gap between 'Actually Available' Food Waste and AD Capacity



3.0 Barriers to Greater Capture of Food Wastes

3.1 Wastes from Food Processing and Manufacturing

The Landfill Tax Escalator has, for some time, been functioning as a driver for waste prevention. Food processing and manufacturing businesses which continue to operate today are commercially viable for a reason; they have already focused on being efficient, and therefore produce far lower tonnages of waste, which might be sent to landfill, than has previously been estimated by Government. As a result, such businesses generally have little desire to contract for long-term treatment of fixed tonnages of food waste for the simple reason that they are seeking to reduce their levels of wastage.¹³ The scope for accessing further feedstocks from the this sector is therefore fairly limited, unless there is better enforcement of the waste hierarchy in future, as discussed in Section 4.3.

¹³ Albeit, it is acknowledged that some exceptions exist where processing industries decide to develop (often on-site) AD facilities, the principle feedstock for which is a by-product of the manufacturing process itself

3.2 Household Food Wastes

Whilst there has been a steady increase in the number of local authorities providing separate food waste collections to households, the 0.3 million tonnes per annum currently collected still represents a small proportion of total food waste arisings.¹⁴

Introducing food waste collection reduces the tonnage of waste which needs to be sent for residual treatment. Many waste collection authorities (WCAs) have no incentive to offer such collections due to the fact that waste disposal authorities have clauses within contracts for the management of their residual waste stream which state that if they supply less than a guaranteed minimum tonnage (GMT) to the contractor, they risk having to pay for the shortfall in waste delivered. This means that once residual waste falls below a certain level, the marginal benefit from avoiding disposal becomes, potentially, zero.¹⁵

It should be noted that in England, in 2012, around 40% of all residual waste was sent for incineration and that this residual waste might comprise up to 40% food waste (where no separate collection system is in place). Unless local authorities renegotiate contracts with their treatment suppliers, or unless they are required to change their approach to waste management (as discussed in Sections 4.3 and 4.4), therefore, large amounts of food waste are likely to remain within the residual waste stream.

3.3 Commercial Food Wastes

As described in Section 2.3 and shown in the outputs from our model in Section 2.4, there is a significant tonnage of food waste arising from commercial premises, which is not currently being separately collected. Collection services for commercial food wastes are currently operated by contractors which vary in scale and coverage; from national waste management companies, to small-scale local operators. Many dedicated food waste collection services are still in their infancy, and whilst some of the major national waste contractors, such as Sita, Biffa and Shanks appear to be marketing commercial food waste collection services relatively aggressively (in the cases of the latter two, primarily to supply their own AD facilities), anecdotal evidence suggests that so far, customer take-up has been relatively weak.

In our aforementioned 2011 AD market report, we described a ‘chicken and egg’ situation whereby the roll-out of food waste collection services by many contractors

¹⁴ It should be noted that this 0.3 million tonnes per annum excludes food waste which is collected mixed with garden wastes. This is currently largely processed at in-vessel composting (IVC) facilities, albeit there are potentially a limited number of ‘dry’ AD facilities being developed to compete for such feedstocks

¹⁵ Some contracts recently signed by local authorities also indicate that no separate collection of food waste will be undertaken, partly so as to ensure that residual treatment facilities can be supplied with sufficient waste

was unlikely to happen without a local AD plant in place, and vice-versa.¹⁶ During the last three years, this position has shifted somewhat, in that there now appears to be sufficient capacity available, but those organisations which are in a position to provide wide roll-out of commercially attractive food waste collections (to the businesses producing food waste) are not responding in such a way as to effect change.

Traditionally, commercial residual ('black bag') waste collection services have been provided using a *volume-based* pricing system. This means that companies receive a service based on the size of their bin and/or frequency of their collections. Food waste is a high density, low volume material. As a result, under a volume-based pricing mechanism removing food waste would release a disproportionately small volume in, (and thus provide only very cost limited savings relating to) the residual container. As a result, this would be unlikely to offset the additional costs of a separate food collection service (potentially from another contractor). Consequently, unless an integrated (and *weight-based*) system and associated pricing mechanism can be provided by the collection contractors, as discussed in more detail in Section 4.1, capture of food wastes from the commercial sector is likely to remain very low.

4.0 Recommendations for 'Unlocking' Food Waste

4.1 Potential New Collection Pricing Mechanisms for Commercial Wastes

As described in Section 3.3, the vast majority of current collection systems for residual waste from the commercial sector are volume-based. That said, some of the large, vertically integrated waste management contractors are considering moves to weight-based pricing mechanisms. These are not only more attractive (albeit more complex) to customers, but can also provide the opportunity for greater revenues, assuming the same contractor operates both elements of the collection service. This approach must take into consideration the full costs of service provision, an example of which is provided in Box 1.

Box 1: Example Rationale for Weight-based Pricing Mechanism

If only residual collection is provided, the contractor has a low cost collection service, but 100% of onward management will be through use of the more costly management routes, i.e. must be managed by way of incineration or landfill (including Landfill Tax), with prices of the order £80-120/tonne. If a food container (and a further container for recyclables i.e. paper, glass, plastics, cans) is added to the service, whilst this raises the costs of collection, it can often be offset by the lower costs of onward management, i.e. only a small fraction will need residual treatment, another fraction will go to AD, whilst there may be revenues from the sale of the recyclable materials stream. The net cost or income to the contractor can therefore often be improved compared with the current situation.

¹⁶ Eunomia (2011) *Anaerobic Digestion Market Outlook: Overcoming Constraints to Deliver New Infrastructure*, July 2011. <http://www.eunomia.co.uk/shopimages/Eunomia%20-%20Anaerobic%20Digestion%20Market%20Outlook%20Report.pdf>

Whilst the new forms of by-weight charging mechanisms in the commercial sector are in their infancy in terms of level of roll-out, Eunomia believes that the initial signs in the market of a move towards such methods of charging are positive. The extent to which this is likely to happen in the short to medium-term, however, is uncertain. It seems necessary to unlock this market by providing services on terms that are attractive to would-be customers at rates that are sufficiently competitive in the collection market.

4.2 Future Trends towards Collaborative Procurement

Traditionally, businesses have individually procured their waste collection services. Cost is often the key or deciding factor and so if a food waste collection incurs additional costs for a company there is little incentive for a company to opt for it. Collaborative procurement is one method for companies to bring down the costs of their waste collection services. Savings can be made as a higher density of customers results in efficiency savings for the waste collector, which can in turn be passed on to the customer. Furthermore with more waste and recyclable available for collection a group of businesses is in a stronger position to gain a better service agreement.

Business Improvement Districts (BIDs) are business-led and business funded bodies formed to improve a defined commercial area. There are 157 BIDs across the UK. Collaborative procurement of waste services through BIDs may see an increase in offering and uptake of food waste collection services due to the potential for more consideration to be given to the structuring of collection services, as well being more economically competitive.

In terms of current progress, Eunomia was recently contracted by Bath BID to carry out a procurement process to select a waste contractor that could offer a high quality, high recycling and low cost service to BID members. The resulting service offers food waste collection at a more competitive price. Eunomia is also now currently working with other BIDs to deliver similar contracts.

4.3 Better Enforcement of the Waste Hierarchy

As discussed above, for some food wastes, AD is often simply not price-competitive compared with alternative management options, such as the pet-food and animal feed markets. Furthermore, these markets can essentially be regarded as representing 'reuse' and therefore sit higher than AD in both the waste hierarchy and the food waste hierarchy.^{17 18}

At the same time, however, rendering, to which some animal by-products, which might have been suitable for AD are sent, is a form of disposal and so sits lower in the hierarchy than AD. In addition, 'direct land application' (often of dairy and other more

¹⁷ Defra (2011) *Guidance on applying the Waste Hierarchy*, June 2011
<http://www.defra.gov.uk/publications/files/pb13530-waste-hierarchy-guidance.pdf>

¹⁸ See <http://www.feeding5k.org/businesses.php>

liquid wastes) cannot really be placed anywhere within the current hierarchy. This suggests that Government should commission further research of such practices, which might in some cases be resulting in questionable environmental benefits.

It will be appreciated that AD sits above incineration in the waste hierarchy, which presents a certain irony as many current local authority residual waste contracts disincentivise food waste collection and AD, as discussed in Section 3.2.

Despite publishing the aforementioned guidance on the waste hierarchy in 2011, the Government has been very slow to fully enforce the hierarchy, or to make clear what its practical implications are for waste collectors. It has therefore provided local authorities with little additional incentive to invest in food waste collection. The task of ensuring compliance with the Waste (England and Wales) Regulations SI 2011 no 988 and the Guidance issued by Defra under Regulation 15 falls to the Environment Agency (EA) in England, and Natural Resources Wales in Wales. The EA issued a briefing note on compliance with the Waste Regulations for the first time on 27th June 2014.¹⁹ It indicated that departure from the hierarchy was permitted 'where reasonable' and supported by evidence, but that organisations should 'apply best practice and target biggest gains'.

In practice, the EA's interpretation of what the hierarchy requires in respect of food waste has so far appeared to be weak. A local anti-incinerator group in Cornwall has asked the EA to take action following the local council's decision to incinerate food waste rather than collecting it for AD, but was told that it is only unlawful to burn or landfill food waste that has already been separated.²⁰ The group is now pursuing a judicial review of the issue, and it may be that the EA is prompted to adjust its position in future. More action by groups in authorities in similar situations might be helpful in this regard, and there are clearly many such authorities. The recent Public Inquiry into the Norfolk incinerator covered these matters, with the waste disposal authority (and its consultants) demonstrating scant regard, let alone, grasp, of its duties in respect of the hierarchy.

4.4 Requirement to Sort Commercial (and Household) Wastes

Whilst there are indications of moves towards the weight-based pricing mechanisms and collaborative procurement exercises described above, progress remains relatively slow. The single most dramatic change that could take place in the market would be the result of regulatory change. From 1 January this year, non-rural businesses in Scotland that produce more than 50kg of food waste per week have been required to set food waste out for separate collection; from 2016 this threshold will fall to 5kg per week. The Welsh Government's Environment Bill White Paper has also proposed giving Welsh Ministers the power to require businesses to separate food waste for

¹⁹ Environment Agency (2014) *Separate Collection of Recyclables Briefing Note*, June 2014, <http://www.mrw.co.uk/Journals/2014/06/27/z/x/v/20140627-Separate-Collection-briefing-note-27-June-2014.pdf>

²⁰ See <http://www.letsrecycle.com/news/latest-news/councils/environment-agency-challenged-over-waste-hierarchy>

collection. Similar regulations apply in Ireland and France, amongst other countries. In England no such legislation currently exists.

There have been a number of calls for a food waste 'landfill ban', but we believe such a blunt instrument would lead both to food waste being treated very inefficiently via incineration (food waste has a very high moisture content), and to significant tonnages still going to landfill, as such bans can be incredibly difficult to enforce.

The key to unlocking food waste from the commercial residual stream is therefore a requirement to sort food waste at source. This would also increase the density of food waste collections, and therefore, increase the efficiency of logistics, helping to reduce collection costs. Requiring separation at source has the additional benefit of giving a visible reminder of the amount of food that is being wasted, thus increasing awareness which is often the first step to taking action to reduce arisings. Our estimates suggest that if the provision of food waste collections has even a marginal effect on waste prevention (reducing arisings by 2%), then this affect alone delivers carbon benefits which exceed the benefits which can be derived from any commercially available waste treatment process through the generation of energy.

Whilst it would be very politically unpalatable to require households to sort food wastes, Government might instead consider a requirement for local authorities to provide a related food waste collection service. This could be supported by a system of 'variable charging', whereby households who do sort their food wastes benefit financially from doing so, as is the case in many other EU Member States.²¹ Such an approach would increase captures of food waste, as well as other recyclables, potentially generating savings for local authorities of the order £0.5 Billion at current costs of treatment and disposal of residual waste.

5.0 Summary of Key Messages

The key messages within this report can be summarised as follows:

1. Our modelling suggests that the UK market has recently reached a 'tipping point' where there is insufficient feedstock being collected to support the operation of new AD facilities which have been designed to treat food waste;
2. Our market intelligence suggests that the majority of food waste from the food processing and manufacturing sector is already separately collected, albeit much of this is sent to alternative markets such as animal feed and pet food;
3. Only relatively small fractions of both household and commercial food wastes, however, are currently being separately collected, and thus, are actually being made available for AD. For both waste types, large proportions of food waste remain in the residual stream;
4. Given the projected increase in AD capacity and a desire from DECC for more generation of energy from AD, alongside discussions regarding a possible 70%

²¹ Often also known as 'pay as you throw' systems

recycling target for municipal waste (by 2030) being proposed by the European Commission, it is becoming increasingly important to consider methods by which food waste can be further unlocked from both the commercial and household sectors;

5. In this respect, in the immediate term, we suggest the following market-driven, commercial approaches to delivering greater capture rates:
 - a. A move towards weight-based pricing mechanisms, which can be an attractive proposition for contractors, which can offer both residual and food waste collections; and
 - b. Procurement of food (and other) waste collection services via collaborative methods, whereby businesses join together to reduce the costs of the service.
6. In the short and medium-term, we also propose the following regulatory measures, as a means to maintaining an upward trend in food waste captures to support growth in the AD sector:
 - a. Tighter adherence to, and enforcement of the waste hierarchy by the EA, as the authority tasked with ensuring compliance with related Guidance published by Defra;
 - b. The introduction of a requirement in England (and Wales) upon businesses to sort food waste at source, as has been introduced in Scotland; and
 - c. The introduction of a requirement for local authorities to provide separate food waste collections to households.

In addition, it should be appreciated that a circular economy is unlikely ever to develop in the way many are hoping as long as the marginal cost of throwing away refuse is zero. Local authorities should therefore be required to implement 'pay as you throw' schemes to enhance captures of food waste and to encourage waste minimisation. It also remains essential for central Government and industry to focus on waste prevention efforts to achieve the most cost effective and environmentally beneficial outcomes in terms of food waste generation and management.

APPENDICES

A.1.0 Appendix 1 - Methodology for Modelling the Capacity Gap

A.1.1 Wastes from Food Processing and Manufacturing

Essentially, the following methodological stages were undertaken to deliver the results presented for this study:

- As part of a study on behalf of WRAP, Eunomia undertook interviews with around 300 businesses which enabled both determination of average food waste arisings per company for a set of food processor ‘typologies’;²²
- The average arisings for 13 typologies do include potential feedstock, which is likely to be sent to competing, low or zero-cost management routes, such as direct land-spreading, or animal feed and pet food markets. This is because it is anticipated that, depending upon the biogas yield potential from such materials, many such wastes could still be attractive to AD plant operators, particularly when there is a shortage of feedstock for which a gate fee might be received;
- The FAME database was drawn upon to provide a list of all sites within SIC Codes which fall under the broader category of ‘food manufacturing and processing’;²³
- Sites from each relevant SIC Code was then allocated within one of Eunomia’s 13 food processor typologies; and
- For each typology, the number of sites was multiplied by the food waste generated per business to determine total food waste arisings per typology.

A.1.2 Households Food Wastes

To determine the status of each waste collection authority (WCA) with regard to whether it is currently collecting food waste, we reviewed the latest data (April 2012 to March 2013) from Defra’s WasteDataFlow (WDF) tool. This was used to identify if food waste collection services are being offered by WCAs, the reported annual tonnages collected, and the number of households to which these services are being provided.

For those WCAs not currently collecting food waste (either separately or mixed with garden waste), we modelled the likelihood of each authority subsequently introducing such a service. These assumed likelihoods were based on the associated contractual status of the waste disposal authority (WDA) with regard to residual waste management.

The assumed food waste yield is based on information published by WRAP (which was developed by Eunomia) and our own more recent extensive experience of a well-executed household collection services. We consider that the maximum such services could

²² Eunomia Research & Consulting (2008) *Regional Compost Supply and Demand: Evaluation of Compost Supply and Demand in South East (including London) and East England*, Report for WRAP, May 2008

²³ FAME = Financial Analysis Made Easy. FAME is a database that contains information for companies in the UK and Ireland. FAME contains information on 2.2 million companies, 2 million of which are in a detailed format. Published by Bureau van Dijk, www.bvdinfo.com/Products/Company-Information/National/FAME.aspx

deliver is around 100 kg of food waste per household per year (kg/hh/yr). Based on current WDF data, however, households on average are presenting around 60kg per annum of food waste for collection. This rate has been steadily increasing over the past few years as households become better educated on separating out their food waste.

In addition, we have used data from the Office of National Statistics to forecast future numbers of households, and household size, which is based on forecast population estimates.

A.1.3 Commercial Food Wastes

It should be noted that there is limited accurate data on commercial wastes (of any nature) in the public domain. We have therefore based our methodology around data extracted from the available sub-sector specific reports on food waste, for example, for the education and hospitality sectors. We believe that this approach is fit-for-purpose, given that there is no available evidence which suggests that, for example, the food waste generated by restaurants in one UK region differs greatly from other regions.

The aforementioned FAME database was again used to quantify the number of businesses, using Standard Industrial Code (SIC) Codes, within each sub-sector.²⁴ These numbers were then multiplied by the amount of food waste generated per business in each sub-sector

Our methodology for determining feedstock availability can be summarised as follows:

1. Use of the following recent research on commercial food waste arisings to determine availability 'per business' across the majority of Eunomia sub-sectors:
 - The 2011 WRAP study on commercial waste in the hospitality industry provided a means by which we could calculate a per business rate of food waste generation for hotels, pubs, fast food outlets, and restaurants;²⁵
 - A report in 2009, which analysed food waste arisings in the education sector in the North East of England, provided the basis for calculating 'per site' tonnages for schools, colleges and universities;²⁶
 - A report from the European Environment Agency, which provides a food waste value per full time equivalent worker of 20kg/annum. We used this information to inform estimates of food waste availability from offices and other places of work where there is no commercial food handling as part of normal business activities.²⁷ By running a series of queries through the

²⁴ FAME = *Financial Analysis Made Easy*. FAME is a database that contains information for companies in the UK and Ireland. FAME contains information on 2.2 million companies, 2 million of which are in a detailed format. Published by Bureau van Dijk, www.bvdinfo.com/Products/Company-Information/National/FAME.aspx

²⁵ WRAP, SKM Enviros, Oxford Brookes University, RLP, ADAS and Urban Mines (2011) *The Composition of Waste Disposed of by the UK Hospitality Industry*, Report for WRAP, July 2011

²⁶ Dr Robert Pocock, D. C. P. W. M. E. L. and Lewis Herbert (WasteWise) (2009) *A Study of Public Sector Food Waste Arisings and Processing Options within the North East Region*, Report for RENEW, 2009

²⁷ European Environment Agency, *EEA Environmental Statement 2007*, June 2007

databases of the Office of National Statistics (ONS), to ascertain the average numbers of staff per business, we were able to derive an average food waste output per business. This was directly applied to the 'offices' sub-sector, whilst a small uplift was applied to non-office businesses that may include an element of the handling of food waste;

2. For some sub-sectors, for which no specific survey data was available, we reverted to a 'top-down, per business' estimate, based on market intelligence;
3. Under both the modelled and 'top down' approaches, the number of businesses within each sub-sector was then multiplied by the food waste per business to determine total availability.
4. Again, based on our market intelligence, we then assumed 10% of the total feedstock was separately collected in the years 2009, rising to 15% in 2023/24.

A.1.4 AD Capacity Forecast

Eunomia maintains an internal Waste Treatment Facility Database which contains information on every waste treatment facility in the UK.

Our approach to determining future AD capacity can be summarised as follows:

- A factor is applied to account for the proportion of a facility's feedstock that has been designed to treat food waste;
- A series of 'weightings' are applied to facilities which are in the development or consenting phase to determine their likelihood of reaching financial close. These weightings are based on a number of factors such as the facility's development status, proposed operator, and contract status;
- Each facility is then given an overall likelihood of reaching financial close based on these weightings. This likelihood is multiplied by the food waste treatment capacity of the proposed facility;
- Summing up all the capacities from this modeling process gives us an estimated forecast, in aggregate, of the tonnage treatment capacity that is likely to come online in the period to 2023/24.