Final report

A survey of the UK Anaerobic Digestion industry in 2013

A report on the structure of the UK Anaerobic Digestion sector and the markets for its outputs
WRAP’s vision is a world where resources are used sustainably.

We work with businesses, individuals and communities to help them reap the benefits of reducing waste, developing sustainable products and using resources in an efficient way.

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Executive summary

The purpose of this study was to quantify the processing of organic material via anaerobic digestion (AD) in the UK using a survey of AD operators. This report summarises the methodology employed and the results obtained from the survey.

Background

A survey of the organics processing industry has been undertaken since the mid-1990s, originally by The Composting Association (with funding from the Environment Agency and WRAP support in later years) and more recently by WRAP with the support of the Anaerobic Digestion and Biogas Association (ADBA), the Renewable Energy Association (REA) and the Environmental Services Association (ESA). As last year’s survey indicated little year-on-year change in the UK composting sector and the AD sector has been developing rapidly, this year resources were focussed on surveying AD only.

Methodology

A telephone survey was carried out between February and April of 2014, collecting data on the state of the sector in the calendar year 2013. Attempts were made to contact all of the AD plants listed on the AD Information Portal map (http://www.biogas-info.co.uk/index.php/ad-map.html), with the exception of water (sewage) treatment plants and mechanical biological treatment (MBT) plants which process residual waste but have an AD plant to process the organic fraction extracted. This survey classifies AD plants into four categories, as follows:

Commercial – sites which accept waste from off-site, on a commercial basis (i.e. for a gate fee). Such sites may be based on a farm.

Industrial – sites which process their own wastes, typically on a large scale, such as food and drink manufacturers.

On-farm – sites which are both located on a farm and process only material generated on-farm (including energy crops).

Demonstration – demonstration/R&D sites. AD sites that process feedstock for demonstration or feasibility purposes. Such sites may contract in waste but not on a large scale.

The response rate was 75%: 88 sites answered at least some of the survey questions, out of an operational population (during 2013) of 117 sites. This compares to a response rate of 70% (61 out of 87 operational sites) in the survey of 2012.

Key Findings

There has been a 34% increase in the total number of operational AD plants between 2012 and 2013, up from 87 to 117 plants, and an increase of 51% in the tonnage of organic material processed, from 1.69 million tonnes to 2.55 million tonnes, excluding those AD plants typically associated with the drinks industry which use AD to process liquid effluent and discharge the treated effluent to sewer.

Total UK employment in the AD sector is estimated at 482 full-time equivalents in 2013 compared to 354 in 2012 i.e. a 36% increase.
The largest increase in numbers of operating plants has been in the commercial AD sector (up from 31 to 37 plants) and on-farm plants (up from 32 to 50). There has also been an increase in the number of industrial sites which discharge treated effluent to sewer, from 11 to 16.

The operating capacity of the AD sector, excluding the industrial sites which discharge treated effluent to sewer, has increased by 55% since 2012, from 2.07 million tonnes to 3.20 million tonnes. Similar rates of increase (i.e. around 50%) have been seen in each of the three main segments: commercial, industrial and on-farm.

There have been increases in all the types of feedstock processed: separated solid food, liquids, manures and crops but food and drink waste continues to be the largest proportion of the material processed, with separated (solid) food at 38% of the reported\(^1\) tonnages and liquids at 30%. Correspondingly, the largest source of feedstock is food manufacturers and processors (66% of the waste organic material processed – i.e. excluding energy crops and manures). This year’s survey saw an increase in the reported tonnages processed from this source from 330,000 tonnes in 2012 to 820,000 tonnes in 2013. In comparison, the reported volume of material sourced from Local Authority collections increased from 170,000 tonnes to 230,000 tonnes. It should be noted that because these are reported tonnages, the changes between 2012 and 2013 are a combination of real growth and improved reporting (more sites providing answers).

Over a million tonnes of digestate were reported to have been applied to agricultural land in 2013, providing benefits in terms of readily available nutrients and potentially lower use of inorganic fertilisers. This represents 98% of the digestate for which a use was reported in the survey and highlights the importance of a ‘land bank’ to which to spread digestate, particularly for commercial AD operators.

There still appear to be very few AD operators who are realising a market value for applying digestate, with those who are prepared to disclose financial arrangements disclosing prices for agricultural application ranging from a cost to their business of £13 per tonne to a revenue of £3 tonne, with an average of -£3.73 per tonne (i.e. a cost to the business).

The increasing number of food and drink manufacturers using AD to process their waste also means that value (mainly energy) is increasingly being created out of waste and untreated waste is less likely to be disposed of to sewer or to land.

Our survey shows that the majority of plants in 2013 were using CHP with very little heat use - much the same as in 2012. Although this survey asks for electricity generation figures, the more authoritative figure for electricity generation by AD is published by DECC at https://www.gov.uk/government/statistics/energy-trends-section-6-renewables.

The survey also asked about attitudes to the PAS110 certification system and responses showed a continuing intention to apply for and maintain certification, mainly among commercial operators.

\(^1\) In this year’s report we have tried to make a clearer distinction between ‘reported’ tonnages – displayed in tables with a blue background – and ‘grossed’ tonnages. Reported tonnages are the totals of the figures provided by respondents and so are entirely dependant on the number of responses provided. For some questions, not all AD operators were able/willing to provide figures, so where a figure is described as ‘reported’ it should not be interpreted as a UK market total.

Grossed tonnages are based on calculating what the figure for the total UK would have been, if we had obtained answers from all AD plants. This calculation is explained in detail in Appendix 3 and is only applied to the headline figures for input, output and capacity; because the number of responses decreases as we analyse subsets, e.g. sites processing material from Local Authorities, applying the same calculation would result in an estimate which would not be sufficiently robust.
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1. Introduction

1.1 Purpose of the Study

The purpose of this in-depth survey is to generate estimates of material processed using anaerobic digestion (AD) in the UK, the capacity of UK AD infrastructure, and the nature and volume of the markets available for the outputs.

WRAP and other public bodies require information and monitoring data on the UK organics treatment sector to assist in directing support resources and informing policy. WRAP also uses the results to help assess the extent to which it is meeting its objectives with respect to developing both AD capacity and markets for AD outputs. The survey also provides important technical information on aspects such as the equipment used by the industry, which is of use to the industry in developing new projects. Investors also find it useful to be able to see from a confidential survey how the industry is developing, so this survey also supports investor confidence in the sector.

1.2 Scope of the work

In recent years, growth in the composting (including IVC) sector has levelled off and the greatest change in the organic reprocessing sector has been seen in the expansion of AD. For this reason WRAP has focussed its resources for the 2013 survey on AD.

This study involved a telephone survey of operators of industrial, commercial and farm based AD plants listed on the AD Information Portal map but excluding AD facilities used for waste water treatment and sites which took input solely from their associated MBT facilities. The database that underlies the AD Information Portal map is the most comprehensive list of AD facilities but it is acknowledged that certain types of sites (such as those on food manufacturing/processing sites and on farms) can be missed if planning permission is not required.

This research focuses on the calendar year 2013 and is comparable with the 2012 survey, which was conducted in 2013.

The results of the survey build on those from previous years. Repeated annually for all organic waste recycling technologies since the mid-1990s, this report has come to be regarded as the most up to date and definitive source of data on the sector.

1.3 Background

A survey of the organics processing industry has been undertaken since the mid-1990s, originally by The Composting Association (with funding from the Environment Agency and with WRAP support in later years) and more recently undertaken by WRAP with the support

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2 The exclusion of MBT AD was for the purposes of compatibility: last year MBT sites were surveyed and reported separately but MBT AD was not distinguished from other MBT.
of the Association for Organics Recycling (AfOR), the Anaerobic Digestion and Biogas Association (ADBA), the Renewable Energy Association (REA) and the Environmental Services Association (ESA). The additional sector bodies have been included to enable representation of the diverse range of technologies now operating in the organics treatment sector, and in particular to track the expansion of AD.

Copies of the four most recent industry-wide surveys can be found on the WRAP website and previous reports (the annual State of the Composting and Biological Waste Treatment Industry reports produced by AfOR) can be found on the ORG website.

1.4 Context

The UK Government made a commitment to work towards a ‘zero waste’ economy in the Coalition Programme for Government, published in May 2010. It had been estimated that in the UK over 10 million tonnes of organic material had been going to landfill. A key focus for WRAP, in support of the Government’s objectives, is the reduction in organic waste sent to landfill and an increase in the amount of this waste stream that is recycled. WRAP’s work in this area takes two forms: supporting growth in organics treatment infrastructure and developing the markets for the recycled materials (compost and digestate). In particular, WRAP’s organics programme is working with Defra to implement the joint Defra/DECC Anaerobic Digestion Strategy and Action Plan, which recognises the role of AD in both diverting organic waste from landfill and generating energy.

The Scottish Government launched Scotland's first Zero Waste Plan in June 2010, setting out the Scottish Government's vision for a zero waste society: a Scotland where all waste is seen as a resource; waste is minimised; valuable resources are not disposed of in landfills, and most waste is sorted and recycled, leaving only limited amounts to be treated. Zero Waste Scotland is funded by the Scottish Government to support the delivery of this Zero Waste Plan and other low carbon and resource efficiency policy priorities.

May 2012 saw the passing of the Waste (Scotland) Regulations 2012 which represent perhaps the most significant development in recycling that Scotland has ever seen and are designed to help us realise the true value of resources we currently throw away. This has the potential to boost Scotland’s economy and create green jobs in the process. The new Regulations will also play a key role in helping Scotland reach its ambitious target of 70% recycling of all waste by 2025. In the context of organic waste, the role for Zero Waste Scotland (ZWS) is to provide practical help and support to implement the joint Defra/DECC Anaerobic Digestion Strategy and Action Plan, which recognises the role of AD in both diverting organic waste from landfill and generating energy.

The Welsh Government has set ambitious targets to achieve zero waste to landfill by 2050. In the context of organic waste, WRAP Cymru is working in partnership to develop Wales' infrastructure for recycling and reprocessing its waste and to increase the diversion of biodegradable waste into quality products such as compost and digestate and create

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3 In 2013 REA and AFOR merged and AFOR is now represented by the Organics Recycling Group (ORG) within REA.

demand for these products. WRAP Cymru is also supporting the development of 7 AD hubs that will treat all the municipal food waste in the country.

The Department of the Environment in Northern Ireland works with WRAP NI to provide support to the organics treatment industry. To increase the diversion of biodegradable waste from landfill the Department recently announced it will make a regulation for restricting source segregated food waste from landfill. The regulation will be effective from April 2015. Businesses will be required to source segregate food waste for collection - 50kg/week and above from 2016 and 5-50kg/week from 2017. Councils will provide separate food waste collections to households by 2017.
2. Methodology

2.1 Introduction

The data for this report was collected via a telephone survey of AD facility operators.

The survey used a structured questionnaire, administered by telephone, to capture data from AD operators. The survey attempted to interview all AD sites operational during 2013, based on the data collected for the AD Information Portal map (available at www.biogas-info.co.uk) but excluding waste water treatment facilities. The telephone survey was carried out by BDS Marketing Research Ltd, contacting individual sites and recording responses electronically during the call.

The survey was publicised by the trade bodies to raise awareness of the survey in the industry so that individuals approached to take part might already have some knowledge of the research. A page was also established on the WRAP website with information on the survey; this provided details of the work and also served to validate the research for any contacts that required it.

This research focuses on the calendar year 2013 and is comparable with the 2012 survey, which was conducted in 2013. As in 2013, the survey was carried out as soon as possible after the end of the calendar year, while detail is reasonably fresh in the operators’ minds. This is in contrast to the surveys for 2009 and 2010 which used regulatory returns as the source for input tonnages. Since the regulatory returns data only become available around 11 months after the end of the year in question, the 2009 and 2010 reports were published in 2011 and 2012, respectively.

The methodology used for the data collection is explained in detail in Appendix 2 and a copy of the questionnaire is included in Appendix 4.
3. Results

This section outlines the results of the analysis of the survey responses, providing narrative where this is required to explain or enhance the results.

Overall, the methodology employed for this survey was similar to that used in for surveying the sector for 2012, and comparisons between results in the two years have been highlighted where appropriate.

**NOTE:**

Some of the tonnages presented in this report are sector estimates, calculated by grossing up, from the survey responses, to make allowance for the sites which did not respond to the survey. These figures are described as “grossed tonnages”.

Other tonnages are the figures reported by the sample of sites which provided answers. These figures are described as “reported tonnages” and tables which contain only such figures are shaded in pale blue. The number of operators providing answers can vary from question to question.

3.1 Survey Performance and Participation

From an initial list of 126 sites in the UK, 4 were deemed not relevant as 3 took input solely from their associated MBT facilities[^5], and 1 was a seasonal waste water treatment facility in Scotland. The remaining 122 sites were contacted by telephone in an attempt to obtain a complete survey response from each. Of these, 31 were new to the survey having, in most cases, started operation in 2013. The survey successfully contacted 119 sites (v. 79 for the survey of 2012) and delivered 88 completed surveys, compared to 61 in 2012. Of those 119 sites contacted, 14 chose not to take part (6 in 2012). Considerable attempts were made to contact the remaining sites, but for a number of reasons surveys were not collected from these sites (such as key contact not available, telephone not answered etc.) Participation rates are summarised in Table 1, increasing from 70% of the UK operational population in 2012 to 75% in 2013.

<table>
<thead>
<tr>
<th>Outcome</th>
<th>No of Sites 2013</th>
<th>No of Sites 2012</th>
</tr>
</thead>
<tbody>
<tr>
<td>Survey undertaken</td>
<td>88</td>
<td>61</td>
</tr>
<tr>
<td>No contact established</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>No response</td>
<td>12</td>
<td>17</td>
</tr>
<tr>
<td>Refused</td>
<td>14</td>
<td>6</td>
</tr>
<tr>
<td>Not operational</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>Not relevant (i)</td>
<td>4</td>
<td>6</td>
</tr>
<tr>
<td>Total Sites listed</td>
<td><strong>126</strong></td>
<td><strong>99</strong></td>
</tr>
<tr>
<td>Operational sites (ii)</td>
<td><strong>117</strong></td>
<td><strong>87</strong></td>
</tr>
<tr>
<td>Survey participation rate (as % of operational sites)</td>
<td>75%</td>
<td>70%</td>
</tr>
</tbody>
</table>

[^5]: For comparison with last year’s report, in which MBT facilities were surveyed and reported separately.
(i) These are these are MBT AD plants and a seasonal water treatment plant in Scotland

(ii) All sites less those not applicable and confirmed not operating

Although there was some success in persuading sites which had not contributed in the 2012 survey to participate this time, there were also sites surveyed in 2012 which did not participate this time. Overall, of the 88 sites surveyed in 2013, 48 had also been surveyed in 2012 (ie. 55% of sites were common to both surveys).

Of the 31 sites new to the survey population in 2013, 9 were commercial plants, 17 on-farm facilities, 4 industrial (one effluent treatment with discharge to sewer) and 1 demonstration. 21 were surveyed, 8 produced no conclusive contact and 2 refused. This 68% participation rate was therefore comparable to the survey as a whole.

Based upon the responses from the sites surveyed, the distribution of operational AD sites in 2013 and those surveyed can be summarised as shown in Table 2. These populations were used as the basis for grossing surveyed input, capacity and output figures to produce a picture of the UK industry as a whole.

<table>
<thead>
<tr>
<th>Classification6</th>
<th>England</th>
<th>Scotland</th>
<th>Wales</th>
<th>N. Ireland</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Commercial</td>
<td>27</td>
<td>5</td>
<td>4</td>
<td>1</td>
<td>37</td>
</tr>
<tr>
<td>Demonstration</td>
<td>5</td>
<td></td>
<td></td>
<td></td>
<td>6</td>
</tr>
<tr>
<td>Industrial</td>
<td>7</td>
<td></td>
<td>1</td>
<td></td>
<td>8</td>
</tr>
<tr>
<td>Industrial – discharging to sewer</td>
<td>12</td>
<td>4</td>
<td></td>
<td></td>
<td>16</td>
</tr>
<tr>
<td>On-farm</td>
<td>39</td>
<td>2</td>
<td>3</td>
<td>6</td>
<td>50</td>
</tr>
<tr>
<td><strong>Total operational</strong></td>
<td><strong>90</strong></td>
<td><strong>11</strong></td>
<td><strong>8</strong></td>
<td><strong>8</strong></td>
<td><strong>117</strong></td>
</tr>
<tr>
<td><strong>Sites Surveyed</strong></td>
<td><strong>66</strong></td>
<td>8</td>
<td>6</td>
<td>8</td>
<td><strong>88</strong></td>
</tr>
<tr>
<td>Participation rate</td>
<td>73%</td>
<td>73%</td>
<td>75%</td>
<td>100%</td>
<td>75%</td>
</tr>
</tbody>
</table>

Comparison to 2012 site populations show increases in the total number of operational facilities in three of the four nations of the UK: England (+20), Wales (+4) and Northern Ireland (+6). In terms of sites surveyed, 17 more sites in England were surveyed in 2013 than 2012, 4 more in Wales and 6 more in Northern Ireland.

Sites were asked to state the year that they started operating and the results obtained are summarised in the following chart, both in terms of the number of facility start-ups per year

6 Definitions used for this study:
- Commercial – sites which accept waste from off-site, on a commercial basis (i.e. for a gate fee). May be a farm based enterprise
- Industrial – sites which process their own wastes, typically on a large scale, such as food and drink manufacturers.
- On-farm – sites which are both located on a farm and process only material generated on-farm (including energy crops)
- Demonstration – demonstration/R&D AD sites that process feedstock for demonstration or feasibility purposes. May contract in waste but not on a large scale
and the cumulative number of start-ups. This shows how rapidly the AD sector has grown, particularly since 2008. Start-up data was available on 120 sites.

Figure 1: Year AD facilities started operation – cumulative number of facilities

3.2 The Size of the AD Sector

To estimate the size of the total UK and individual nation inputs, capacities and outputs, the data from the surveyed 88 sites were used to estimate the data for the remaining 29, using the same methodology as last year, which is summarised in Appendix 3.

AD sites classified as ‘industrial’ include facilities located on the same sites as drinks manufacturers, breweries and distilleries which process large volumes of liquid and discharge to sewer. Eleven of these sites were identified in the 2012 survey, increasing to 16 in the 2013 survey, including 2 sites which became operational in 2013. Surveys were completed for 9 of these sites for 2013, compared to 5 for 2012. These industrial sites were least likely to participate in the survey and even those that did were unable to provide answers to many of the questions. As these sites process typically in excess of 500,000 tonnes of input material per annum and do not produce a digestate for supply to users, they have a considerable impact on grossed inputs but no impact on the digestate end market. Therefore for clarity, information for these facilities is generally reported separately. However, those industrial sites which in general process smaller volumes and can produce a digestate for market, have been included in the following results.

Table 3 summarises the estimates for inputs, operating capacity, outputs and number of employees.
Table 3: Size of the UK and National AD sector 2013 *(i)(ii)*

<table>
<thead>
<tr>
<th></th>
<th>England</th>
<th>Scotland</th>
<th>Wales</th>
<th>N Ireland</th>
<th>UK Total</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Input - Surveyed</strong> (tonnes)</td>
<td>1,650,000</td>
<td>110,000</td>
<td>90,000</td>
<td>160,000</td>
<td>2,010,000</td>
</tr>
<tr>
<td><strong>Input - Grossed</strong> (tonnes)</td>
<td>2,140,000</td>
<td>130,000</td>
<td>115,000</td>
<td>165,000</td>
<td>2,550,000</td>
</tr>
<tr>
<td>Grossed Input 2012 (tonnes)</td>
<td>1,530,000</td>
<td>120,000</td>
<td></td>
<td></td>
<td>1,690,000</td>
</tr>
<tr>
<td>Change 2013 v 2012</td>
<td>40%</td>
<td>9%</td>
<td></td>
<td></td>
<td>51%</td>
</tr>
<tr>
<td>Operating Capacity**(iii)** – Surveyed (tonnes)</td>
<td>2,610,000</td>
<td>170,000</td>
<td>100,000</td>
<td>150,000</td>
<td>3,030,000</td>
</tr>
<tr>
<td><strong>Operating Capacity</strong>(iii) – Grossed (tonnes)</td>
<td>2,730,000</td>
<td>170,000**(iv)**</td>
<td>135,000</td>
<td>165,000</td>
<td>3,200,000</td>
</tr>
<tr>
<td>Grossed Operating Capacity 2012 (tonnes) <em>(iii)</em></td>
<td>1,830,000</td>
<td>190,000</td>
<td></td>
<td></td>
<td>2,070,000</td>
</tr>
<tr>
<td>Change 2013 v 2012</td>
<td>49%</td>
<td>-11%<strong>(v)</strong></td>
<td></td>
<td></td>
<td>55%</td>
</tr>
<tr>
<td>Digestate - Surveyed (tonnes)</td>
<td>1,340,000</td>
<td>100,000</td>
<td>60,000</td>
<td>120,000</td>
<td>1,620,000</td>
</tr>
<tr>
<td><strong>Digestate - Grossed</strong> (tonnes)</td>
<td>1,760,000</td>
<td>120,000</td>
<td>70,000</td>
<td>140,000</td>
<td>2,120,000</td>
</tr>
<tr>
<td>Grossed Digestate 2012 (tonnes)</td>
<td>1,310,000</td>
<td>110,000</td>
<td></td>
<td></td>
<td>1,440,000</td>
</tr>
<tr>
<td>Change 2013 v 2012</td>
<td>34%</td>
<td>12%</td>
<td></td>
<td></td>
<td>47%</td>
</tr>
<tr>
<td>Employees – Surveyed (FTE)</td>
<td>236</td>
<td>45</td>
<td>13</td>
<td>12</td>
<td>306</td>
</tr>
<tr>
<td><strong>Employees – Grossed</strong> (FTE)</td>
<td>322</td>
<td>70</td>
<td>17</td>
<td>12</td>
<td>421</td>
</tr>
<tr>
<td>Grossed Employees 2012 (FTE)</td>
<td>276</td>
<td>62</td>
<td></td>
<td></td>
<td>354</td>
</tr>
<tr>
<td>Change 2013 v 2102</td>
<td>17%</td>
<td>13%</td>
<td></td>
<td></td>
<td>19%</td>
</tr>
</tbody>
</table>

(i) Input, capacity, digestate and employment data exclude industrial sites co-located with drinks manufacturers, breweries and distilleries which process large volumes of liquid and discharge to sewer. It is estimated that these facilities amounted to an additional 7.5 million tonnes of input in 2013 (v. 6 million in 2012).

(ii) Tonnages are rounded to the nearest 10,000 tonnes (5,000 tonnes for Wales and N. Ireland) and as a result UK totals may not be the sum of the nation figures; % change based upon actual tonnages

(iii) Plant operators were asked for the practical operational capacity of their site, which can differ significantly from the permitted capacity.

(iv) Even though only 8 out of 11 sites in Scotland gave a full survey response, all 11 sites confirmed their operating capacity figures.

(v) 2012 UK figures were for all 4 nations. Welsh and NI data suppressed to avoid disclosing data on individual sites

(vi) Operating capacity is recorded as having reduced between 2012 and 2013 in Scotland because one site gave an operational capacity which was 20,000 tonnes lower and stated that they are already operating at the limit of their operational capacity.
Grossing up the operators’ estimates of the operating capacity of the surveyed sites leads to an estimate for UK operating capacity (excluding industrial facilities processing large volumes of liquids and discharging to sewer) of 3.2 million tonnes which is an increase of 1.2 million tonnes (55%) from 2012. Similarly input for 2013 has been estimated at 2.6 million tonnes i.e. an increase on 2012 of 860,000 tonnes i.e. 51%.

This implies a utilisation of capacity of 80%, similar to the 82% calculated in 2012.

The significant increase in input and capacity from 2012 to 2013 is evidenced by:

- the 21 survey responses of the 31 sites new to the survey in 2013 which reported 670kt operational capacity and 350kt of additional input. These figures exclude the two new industrial sites which discharge to sewer.

- Increases in reported input tonnages with 23 of the 48 sites common to both surveys (decreases with 10 sites)

The UK input and capacity totals split by site type and nation are shown in Tables 4 and 5 and the UK total figures are summarised in Figures 2 and 3. These show that growth has been seen in all categories of AD, with input at commercial facilities increasing by 440,000 tonnes.

Table 4: Grossed estimates of UK and National AD sector inputs in 2013, by type of site, tonnes (i)(ii)

<table>
<thead>
<tr>
<th>Classification</th>
<th>England</th>
<th>Scotland</th>
<th>Wales</th>
<th>N. Ireland</th>
<th>UK Total</th>
<th>UK total 2012</th>
<th>Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Commercial</td>
<td>1,060,000</td>
<td>90,000</td>
<td>40,000</td>
<td>35,000</td>
<td>1,230,000</td>
<td>790,000</td>
<td>56%</td>
</tr>
<tr>
<td>Demonstration</td>
<td>20,000</td>
<td></td>
<td></td>
<td>5,000</td>
<td>30,000</td>
<td>10,000</td>
<td>255%</td>
</tr>
<tr>
<td>Industrial (i)</td>
<td>450,000</td>
<td>20,000</td>
<td></td>
<td>120,000</td>
<td>820,000</td>
<td>630,000</td>
<td>82%</td>
</tr>
<tr>
<td>On-farm</td>
<td>610,000</td>
<td>40,000</td>
<td>55,000</td>
<td>165,000</td>
<td>2,550,000</td>
<td>1,690,000</td>
<td>51%</td>
</tr>
<tr>
<td>Total (i)</td>
<td>2,140,000</td>
<td>130,000</td>
<td>115,000</td>
<td>165,000</td>
<td>2,550,000</td>
<td>1,690,000</td>
<td>51%</td>
</tr>
</tbody>
</table>

(i) Excludes industrial sites processing large volumes of liquid and discharging to sewer
(ii) Tonnages rounded to the nearest 10,000 tonnes (5,000 tonnes for Wales and N. Ireland); annual change based on actual figures

Table 5: Grossed estimates of UK and National AD operational capacity in 2013, by type of site, tonnes (i)(ii)

<table>
<thead>
<tr>
<th>Classification</th>
<th>England</th>
<th>Scotland</th>
<th>Wales</th>
<th>N. Ireland</th>
<th>UK Total</th>
<th>UK total 2012 (i)</th>
<th>Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Commercial</td>
<td>1,330,000</td>
<td>130,000</td>
<td>65,000</td>
<td>35,000</td>
<td>1,560,000</td>
<td>990,000</td>
<td>58%</td>
</tr>
<tr>
<td>Demonstration</td>
<td>20,000</td>
<td></td>
<td></td>
<td>5,000</td>
<td>30,000</td>
<td>10,000</td>
<td>151%</td>
</tr>
<tr>
<td>Industrial (i)</td>
<td>530,000</td>
<td>20,000</td>
<td></td>
<td>125,000</td>
<td>1,070,000</td>
<td>710,000</td>
<td>52%</td>
</tr>
<tr>
<td>On-farm</td>
<td>850,000</td>
<td>40,000</td>
<td>55,000</td>
<td></td>
<td>2,070,000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total (i)</td>
<td>2,730,000</td>
<td>170,000</td>
<td>135,000</td>
<td>165,000</td>
<td>3,200,000</td>
<td>2,070,000</td>
<td>55%</td>
</tr>
</tbody>
</table>

(i) Excludes industrial sites processing large volume of liquid and discharging to sewer
(ii) Tonnages rounded to the nearest 10,000 tonnes (5,000 tonnes for Wales and N. Ireland); annual change based on actual figures
Figure 2: Grossed estimates of UK and National AD sector inputs in 2012 and 2013, by type of site, tonnes

Figure 3: Grossed estimates of UK and National AD sector operational capacity in 2012 and 2013, by type of site, tonnes
3.3 Supply Chain Flow

The compiled data has been brought together in a “Sankey” flow diagram. This gives a graphical representation of the flows of the organic material from collection to final market application running top to bottom in the direction of the arrows.

The width of the boxes in Sankey diagrams is proportional to the quantity of material in tonnes. Similarly the width of arrows between process stages represents the tonnage flow (for each arrow, quantities are also given in figures).

The figure overleaf is the Sankey diagram for AD flows, excluding industrial sites co-located with drinks manufacturers which process large volumes of liquid and discharge to sewer.

When the inputs for each type of facility are grossed it has an effect on the proportion of the different feedstocks. Grossed figures are used in the Sankey diagram whereas survey results are noted elsewhere in the report.
Figure 4: UK Anaerobic Digestion 2013 supply chain flow
3.4 Feedstock

3.4.1 Sources

Operators were asked to quantify their inputs by material type, and to identify the sources as % of each type. 72 sites, compared to 56 in 2012, provided this level of detail, detailing inputs of some 6.27 million tonnes compared to 4.43 million reported in 2012.

However, this includes 4.25 million tonnes inputs associated with the industrial facilities that process large volumes of liquid and discharge to sewer (3.49 million tonnes in 2012). Removing this shows an almost doubling in reported input tonnage (2 million tonnes in 2013 compared to 0.94 million in 2012) due in large part to the increased number of facilities and the higher participation and reporting rate.

Studying the reported figures in more detail we can see that for UK AD sites in 2013, separated solid food\(^7\) accounted for 38% by weight of the input reported, down in proportion from 41% in 2012, and liquids increased to 30% of that reported compared to 17% in 2012. The bulk of the increase in reported liquid inputs was to smaller industrial sites, a mixture of dairies and other food processing sites. Agricultural materials such as purpose grown energy crops and manures accounted for 31% (38% in 2012) of inputs in total. These figures are summarised in Figure 5.

Figure 5: Feedstock type, total reported tonnages, UK 2012 v. 2013

\(^{7}\) The term ‘separated solid food’ is used to distinguish (a) from food collected mixed with green waste (typically by local authorities) and (b) from liquid food such as milk and drinks

---

(i) Excludes feedstock for industrial facilities that discharge to sewer
Consideration of feedstock sources by AD facility type shows a variation in feedstock between facility types which reflects the typology: commercial sites mainly use separated solid food and liquids, on-farm sites purpose grown crops and manures, and industrial sites liquids. Surveyed tonnages per facility type are given in Table 6, with % input per site type in Figure 6:

Table 6: Feedstock types per AD facility type (reported tonnages), UK 2013

<table>
<thead>
<tr>
<th>Facility Type</th>
<th>Purpose Grown Crops</th>
<th>Manures</th>
<th>Separated Solid Food</th>
<th>Liquids</th>
<th>Mixed food &amp; green</th>
<th>Other[^]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Commercial</td>
<td>20,000</td>
<td>40,000</td>
<td>670,000</td>
<td>170,000</td>
<td>(*)</td>
<td>10,000</td>
</tr>
<tr>
<td>Demonstration</td>
<td>20,000</td>
<td>10,000</td>
<td>(*)</td>
<td>(*)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Industrial</td>
<td>60,000</td>
<td>400,000</td>
<td>(*)</td>
<td>(*)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>On-farm</td>
<td>280,000</td>
<td>200,000</td>
<td>80,000</td>
<td>30,000</td>
<td>(*)</td>
<td></td>
</tr>
<tr>
<td><strong>Feedstock totals</strong></td>
<td><strong>300,000</strong></td>
<td><strong>260,000</strong></td>
<td><strong>820,000</strong></td>
<td><strong>610,000</strong></td>
<td>(*)</td>
<td><strong>10,000</strong></td>
</tr>
<tr>
<td>excluding sites</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>discharging to sewer</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2012 Feedstock totals</td>
<td>200,000</td>
<td>160,000</td>
<td>390,000</td>
<td>160,000</td>
<td>10,000</td>
<td>40,000</td>
</tr>
<tr>
<td>excluding sites</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>discharging to sewer</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2013 Industrial sites</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>discharging to sewer</td>
<td>10,000</td>
<td>4,250,000</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

[^]: No information on the remaining ‘other’ feedstocks was provided. The apparent reduction between 2012 and 2013 is mainly due to better information from respondents which allowed ‘other’ to be categorised.

(*) represents figures below 5,000 tonnes as all figures are rounded to the nearest 10,000

**Note:** the figures in this table relate to the 72 sites that provided this level of detail, it is different to the market estimates for total input in the AD sector which are the result of grossing.

With data from many more sites in 2013, there is a corresponding increase in the reported tonnages. However, the quantity of separated solid food reported has almost doubled between 2012 and 2013 arising largely from increases at commercial (+340kt) and on-farm (+80kt) facilities. A similarly large increase in agricultural wastes was processed exclusively through on-farm AD facilities.

In contrast the volume of mixed food and green has reduced slightly with 4 sites reporting small volumes for 2013 that together amounted to less than 5,000 tonnes compared to a single site in 2012 taking just over 5,000 tpa.
For waste types other than purpose-grown crops and manures, operators were asked to identify sources of these materials.

By reported weight, and excluding the industrial facilities which process large volumes of liquid and discharge to sewer, the majority of the non-agricultural input material came from food & drink manufacturers and processors (66% of the total reported), local authority collections (19%) and supermarkets (8%). Reported quantities are given in the table below and summarised in Figure 6 alongside the comparable figures for 2012.

Table 7: Feedstock sources by feedstock type (reported tonnages), UK 2013

<table>
<thead>
<tr>
<th>Source</th>
<th>Local Authority</th>
<th>Agriculture</th>
<th>Supermarkets</th>
<th>Hospitality</th>
<th>Food manufacturers</th>
<th>Other</th>
</tr>
</thead>
<tbody>
<tr>
<td>Food-Solid</td>
<td>230,000</td>
<td>40,000</td>
<td>100,000</td>
<td>20,000</td>
<td>280,000</td>
<td></td>
</tr>
<tr>
<td>Liquids</td>
<td>10,000</td>
<td></td>
<td></td>
<td></td>
<td>530,000</td>
<td></td>
</tr>
<tr>
<td>Mixed food &amp; green</td>
<td>(*)</td>
<td>(*)</td>
<td>(*)</td>
<td>(*)</td>
<td>(*)</td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td>10,000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Source Totals</strong></td>
<td><strong>230,000</strong></td>
<td><strong>50,000</strong></td>
<td><strong>100,000</strong></td>
<td><strong>30,000</strong></td>
<td><strong>820,000</strong></td>
<td><strong>10,000</strong></td>
</tr>
</tbody>
</table>

(*) represents figures below 5,000 tonnes as all figures are rounded to the nearest 10,000
(Excludes feedstock for industrial facilities that discharge to sewer)

(i) i.e. excluding purpose grown crops & manures

Although the overall tonnages increased as shown above, the proportion of reported waste input from local authorities decreased from 30% in 2012 to 19% in 2013, and waste from food manufacturers increased from 56% to 66%. These changes reflect the nature of the sites which started operations in 2013, 84% of whose input came from food manufacturers, and only 10% from local authorities.

Considering waste based inputs (i.e. excluding purpose grown crops and manures) by AD facility type shows commercial facilities sourcing feedstock mainly from local authority collections and food manufacturers, industrial facilities almost exclusively from food processors and manufacturers, and on-farm facilities from agriculture and supermarkets. Reported sources in tonnes are summarised in Table 8 and the split of sources for commercial sites is shown in Figure 8.

### Table 8: Feedstock sources per AD facility type (reported tonnages), UK 2013

<table>
<thead>
<tr>
<th>Facility Type</th>
<th>Local authority collections</th>
<th>Agriculture</th>
<th>Supermarkets/retail</th>
<th>Hospitality</th>
<th>Food manufacturers/processors</th>
<th>Other</th>
</tr>
</thead>
<tbody>
<tr>
<td>Commercial</td>
<td>230,000</td>
<td>20,000</td>
<td>100,000</td>
<td>20,000</td>
<td>390,000</td>
<td>0</td>
</tr>
<tr>
<td>Demonstration</td>
<td>(*)</td>
<td>(              )</td>
<td>(*)</td>
<td>(              )</td>
<td>10,000</td>
<td></td>
</tr>
<tr>
<td>Industrial</td>
<td>(*)</td>
<td>410,000</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>On-farm</td>
<td>30,000</td>
<td>(              )</td>
<td>(              )</td>
<td>10,000</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Source totals</strong></td>
<td><strong>230,000</strong></td>
<td><strong>50,000</strong></td>
<td><strong>100,000</strong></td>
<td><strong>30,000</strong></td>
<td><strong>820,000</strong></td>
<td><strong>10,000</strong></td>
</tr>
<tr>
<td>Industrial – discharging to sewer</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

(*) represents figures below 5,000 tonnes as all figures are rounded to the nearest 10,000
Respondents were also asked if their inputs were sourced on or off site. Of the sites responding and including ‘industrial to sewer’ sites, 78% of feedstock by weight came from the same site as the AD operation (industrial and on-farm sites), 6% came from the same site as the facility but from another business (mostly industrial), and 16% from off site (mostly commercial).

Compared to last year’s survey, the proportion of material from external sources for commercial sites was similar; for industrial sites, a larger proportion this year was reported from other sites belonging to the same business, while on-farm sites reported receiving some material (20%) from off-site sources which is not something that was reported last year.
3.4.2 Contamination

Operators were asked what level of reject material they typically found in their feedstock. This was defined as the non-biodegradable material that came in with the organic feedstocks and that the operator would have had to dispose of. The level of rejected material is likely to vary considerably from load to load but since they will have had to dispose of it as waste, operators were expected to have records to which they could refer.

Rejection is less relevant for sites taking on-site generated inputs, as can be seen in the summary table below. For commercial sites higher levels of rejection are an issue, with 21% (25% 2012) of commercial site respondents reporting reject levels of 6-10%, and 25% (17% 2012) reporting rejects over 10%. These results are illustrated in Figure 10.

<table>
<thead>
<tr>
<th>Table 9: Level of contamination of feedstock by facility type, UK 2013</th>
</tr>
</thead>
<tbody>
<tr>
<td>Less than 1%</td>
</tr>
<tr>
<td>----------------</td>
</tr>
<tr>
<td>1% or more</td>
</tr>
</tbody>
</table>
3.5 Process and Technology

The survey collected data on the process types and technology being used in UK anaerobic digestion facilities. These figures include data collected from the 9 surveyed industrial facilities that process large volumes of liquid and discharge to sewer, excluded from the sector size calculations. These are reported separately where they have a significant impact on the overall AD industry picture.

3.5.1 Process

Of all the sites surveyed in the UK, 47 ran a single stage process compared to 32 two stage. This compares to 39 single stage and 21 two stage sites reported in 2012. In Scotland there would appear to be a higher proportion of sites using single stage (6 sites reported single stage, 2 two stage), whilst in both Northern Ireland and Wales there was an equal split between sites reporting using single stage and those reporting using two stage.

In contrast, the majority (10 out of 18) of those sites new to the survey in 2013 reported using two stage processes.

The number of process stages varied by site type as shown in Table 10 below, with commercial facilities most likely to use a two stage process and industrial sites most likely to use a single stage.

---

* A single stage system is defined as one which utilises just one sealed reactor and a two stage system utilises two
Table 10: Single v Two stage process, by AD site classification (as number of sites responding), UK 2013 v 2012

<table>
<thead>
<tr>
<th>Facility Type</th>
<th>2013</th>
<th></th>
<th>2012</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Single Stage</td>
<td>Two Stage</td>
<td>Single Stage</td>
<td>Two Stage</td>
</tr>
<tr>
<td>Commercial</td>
<td>15</td>
<td>15</td>
<td>13</td>
<td>12</td>
</tr>
<tr>
<td>Demonstration</td>
<td>1</td>
<td>1</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>Industrial</td>
<td>3</td>
<td>1</td>
<td>5</td>
<td>1</td>
</tr>
<tr>
<td>Industrial discharging to sewer</td>
<td>8</td>
<td>1</td>
<td>4</td>
<td>1</td>
</tr>
<tr>
<td>On-Farm</td>
<td>20</td>
<td>14</td>
<td>14</td>
<td>6</td>
</tr>
<tr>
<td><strong>Total sites responding</strong></td>
<td><strong>47</strong></td>
<td><strong>32</strong></td>
<td><strong>39</strong></td>
<td><strong>21</strong></td>
</tr>
</tbody>
</table>

Most facilities i.e. 71 of 83 overall (54 of 61 in 2012), ran a continuous process, and 12 a batch process\(^9\) (6 in 2012), with no significant differences between nations. By site classification, responses show that none of the demonstration sites or industrial sites discharging to sewer use batch processing.

Similarly 14 of the 18 facilities new to the 2013 survey were operating continuous processes.

Table 11: Continuous v Batch process, by AD site classification (as number of sites responding), UK 2013 v 2012

<table>
<thead>
<tr>
<th>Facility Type</th>
<th>2013</th>
<th></th>
<th>2012</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Continuous</td>
<td>Batch</td>
<td>Continuous</td>
<td>Batch</td>
<td>Both</td>
<td></td>
</tr>
<tr>
<td>Commercial</td>
<td>24</td>
<td>6</td>
<td>20</td>
<td>4</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Demonstration</td>
<td>4</td>
<td>4</td>
<td>0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Industrial</td>
<td>3</td>
<td>2</td>
<td>6</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Industrial discharging to sewer</td>
<td>9</td>
<td>5</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>On-Farm</td>
<td>31</td>
<td>4</td>
<td>19</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Total sites responding</strong></td>
<td><strong>71</strong></td>
<td><strong>12</strong></td>
<td><strong>54</strong></td>
<td><strong>6</strong></td>
<td><strong>1</strong></td>
<td></td>
</tr>
</tbody>
</table>

Most facilities ran a wet process\(^10\) although 4 facilities, consisting of two commercial sites and two on-farm sites, report using a dry process. Two facilities reported using a dry process in the 2012 survey. In 2013, 2 on-farm facilities in England reported using both wet and dry systems – both sites were run by the same operator.

---

\(^9\) Continuous processing is a system where waste can be continually added and removed without stopping the system; with a batch system, the process has to be stopped to allow more waste to be introduced.

\(^10\) Wet processes utilise 5-15% dry matter in the digester, dry processes over 15% dry matter in the digester.
3.5.2 Operating Conditions

The majority of facilities i.e. 66 of 82 reporting (compared to 52 of 61 in 2012) reported using a mesophilic process\textsuperscript{11}. The summary by site classification is given in the table below:

<table>
<thead>
<tr>
<th>Facility Type</th>
<th>2013 Mesophilic</th>
<th>2013 Thermophilic</th>
<th>2012 Mesophilic</th>
<th>2012 Thermophilic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Commercial</td>
<td>25</td>
<td>4</td>
<td>22</td>
<td>3</td>
</tr>
<tr>
<td>Demonstration</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>0</td>
</tr>
<tr>
<td>Industrial</td>
<td>4</td>
<td>1</td>
<td>7</td>
<td>0</td>
</tr>
<tr>
<td>Industrial discharging to sewer</td>
<td>7</td>
<td>2</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>On-Farm</td>
<td>26</td>
<td>9</td>
<td>16</td>
<td>4</td>
</tr>
<tr>
<td><strong>Total sites responding</strong></td>
<td><strong>66</strong></td>
<td><strong>16</strong></td>
<td><strong>52</strong></td>
<td><strong>9</strong></td>
</tr>
</tbody>
</table>

The mean of the hydraulic retention times reported, i.e. the number of days that material is held in the anaerobic digester, was 46 days (43 days in 2012) although responses varied considerably. Seven of the nine sites reporting 10 days or less were "industrial discharge to sewer" sites and all four of the sites reporting over 100 days were on-farm. For those sites new to the survey in 2013, mean retention time was slightly higher than the population as a whole, at 52 days. The overall distribution of responses is given in Figure 11, showing a similar distribution in 2013 to 2012.

\textsuperscript{11} Mesophilic anaerobic digestion operates at temperatures between 20°C and about 40°C, typically 37°C. Thermophilic digesters operate at temperatures above 50°C.
Considering retention time by process type and conditions, from the data received it appears that the number of process stages has the most noticeable impact on hydraulic retention time, increasing from an average of 43 days for single stage to 52 days for two stages, mirroring results obtained last year (41 days and 50 days). The high figure for Thermophilic processes appears to have been influenced by some on-farm sites using very long retention times.

### Table 13: Average hydraulic retention time v process conditions, UK 2013 v 2012

<table>
<thead>
<tr>
<th>Process Parameter</th>
<th>Options</th>
<th>Average retention time 2013 (Days)</th>
<th>Average retention time 2012 (Days)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of process stages</td>
<td>Single Stage (42)</td>
<td>43</td>
<td>41</td>
</tr>
<tr>
<td></td>
<td>Two Stage (30)</td>
<td>52</td>
<td>50</td>
</tr>
<tr>
<td>Continuous or batch operation</td>
<td>Continuous (64)</td>
<td>48</td>
<td>44</td>
</tr>
<tr>
<td></td>
<td>Batch (11)</td>
<td>33</td>
<td>41</td>
</tr>
<tr>
<td>Dry Matter content</td>
<td>Wet (70)</td>
<td>47</td>
<td>44</td>
</tr>
<tr>
<td></td>
<td>Dry (3)</td>
<td>34</td>
<td>34</td>
</tr>
<tr>
<td>Process Temperature</td>
<td>Mesophilic (60)</td>
<td>42</td>
<td>43</td>
</tr>
<tr>
<td></td>
<td>Thermophilic (15)</td>
<td>59</td>
<td>45</td>
</tr>
</tbody>
</table>

Note: the numbers in brackets represent the numbers of sites providing data in 2013, as an indication of the robustness of the results.

### 3.5.3 Pasteurisation

Of the facilities responding to this question, 28 of 66 sites reported using pasteurisation, of these 17 reported pre and 17 post digestion. This compares to 25 of 37 reporting pasteurisation (13 pre and 15 post digestion) in 2012. Of those facilities saying they did not pasteurise, 5 (mostly facilities associated with breweries) reported that their feedstock was already pasteurised on receipt. Reviewing how the application of pasteurisation corresponds to the use of individual feedstocks, from those facilities which reported input tonnages survey responses show the widespread use of pasteurisation for facilities taking separated solid foods (92% of input), but that pasteurisation was not used extensively when processing purpose grown crops or manures. This aligns well with the regulatory requirements for the different materials.

### Table 14: Use of pasteurisation v. input material, as % of total input UK 2013

<table>
<thead>
<tr>
<th>Purpose</th>
<th>Manures</th>
<th>Separated Solid Food</th>
<th>Liquids (*)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grown Crops</td>
<td>13%</td>
<td>14%</td>
<td>92%</td>
</tr>
<tr>
<td>Not Pasteurised</td>
<td>87%</td>
<td>86%</td>
<td>8%</td>
</tr>
</tbody>
</table>

(*) excludes industrial facilities which discharge to sewer, none of which apply pasteurisation.

### 3.5.4 Pre-Processing

When waste is received at an AD facility it is subjected to pre-processing to prepare the material before it is added to the digester. Of the 63 sites that responded to this question,
the majority reported using mixing and blending (42 sites v 29 in 2012) and shredding (28 v 20 in 2012). Only 10 sites (7 in 2012) reported hand picking, and 22 (12 in 2012) depackaging.

The proportions using each method are summarised in Figure 11 below, comparing responses from this survey to 2012.

![Figure 12: Pre-processing - % of respondents (multiple responses possible), UK 2013 v. 2012](image)

Other reported methods included macerating (9 sites v 3 in 2012), pH correction (3 sites v 2 in 2012) and harvester cuts12 (3 sites v 2 in 2012) with three on-farm sites additionally reporting chopping inputs prior to digestion. One commercial site reported using autoclaving “for additional recovery of organic matter for digestion as caddy liners are dissolved during autoclaving”.

Breaking down responses by site classification shows mixing and blending used by a majority of all site types except industrial sites discharging to sewer. However other pre-processing approaches were used more variably: for example screening was applied by 7 of 22 respondents for on-farm facilities and all i.e. 5 of 5 respondents for industrial facilities discharging to sewer; hand picking was applied at only commercial and on-farm sites.

---

12 The sites reporting “harvester cuts” as a pre-processing operation use only crops for their AD and the pre-processing used is that at harvest time the harvester chops the crop into small pieces (about 10mm long) which is then used as feedstock for the digesters.
Table 15: Pre-processing by site classification - number of respondents (multiple responses possible), UK 2013

<table>
<thead>
<tr>
<th></th>
<th>Screening</th>
<th>Shredding</th>
<th>Hand picking</th>
<th>De-packaging</th>
<th>Pulping</th>
<th>Blending / mixing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Commercial</td>
<td>11</td>
<td>18</td>
<td>8</td>
<td>19</td>
<td>8</td>
<td>20</td>
</tr>
<tr>
<td>Demonstration</td>
<td>1</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td>2</td>
</tr>
<tr>
<td>Industrial</td>
<td>1</td>
<td>1</td>
<td></td>
<td>2</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>Industrial - discharging to sewer</td>
<td>5</td>
<td>1</td>
<td></td>
<td></td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>On-Farm</td>
<td>7</td>
<td>7</td>
<td>2</td>
<td>1</td>
<td>3</td>
<td>16</td>
</tr>
<tr>
<td>All types</td>
<td>25</td>
<td>28</td>
<td>10</td>
<td>22</td>
<td>12</td>
<td>42</td>
</tr>
</tbody>
</table>

Cross-referencing the pre-processing to feedstock source gives the results summarised in the table below.

Table 16: Pre-processing by feedstock source – number of respondents (multiple responses possible), UK 2013

<table>
<thead>
<tr>
<th>Feedstock source</th>
<th>Screening</th>
<th>Shredding</th>
<th>Hand picking</th>
<th>De-packaging</th>
<th>Pulping</th>
<th>Blending / mixing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Food Processors/ Manufacturers</td>
<td>15</td>
<td>14</td>
<td>5</td>
<td>14</td>
<td>7</td>
<td>20</td>
</tr>
<tr>
<td>Local Authority Collections</td>
<td>8</td>
<td>11</td>
<td>6</td>
<td>7</td>
<td>2</td>
<td>9</td>
</tr>
<tr>
<td>Agriculture</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>Hospitality</td>
<td>3</td>
<td>7</td>
<td>4</td>
<td>6</td>
<td>3</td>
<td>8</td>
</tr>
<tr>
<td>Supermarket</td>
<td>3</td>
<td>6</td>
<td>3</td>
<td>8</td>
<td>1</td>
<td>6</td>
</tr>
</tbody>
</table>

Note: sites can have several sources of feedstock and so will be ‘double-counted’ in this table.

Of the 14 sites reporting taking feedstock from local authority collections, 6 sites reported hand picking and 7 sites de-packaging. This compares to just 1 site hand picking and 3 sites de-packaging from the 15 sites reporting taking local authority material in 2012.

3.5.5 Odour Treatment

Of the 88 sites responding to this question, just over half ie. 46 sites, reported using odour treatment. Sites were not specifically asked what type of odour management they were using but some volunteered this information. Of these, 9 sites reported using biofilters with an additional 4 sites specifying bark filters. Two sites reported using alkali scrubbers, with single sites reporting using gas flaring and UV irradiation.
3.6 Outputs

Sites were asked to report on their production of biogas and digestate and how these are utilised.

3.6.1 Biogas & Heat

Of the 88 sites surveyed, only 51 provided a figure for their biogas yield (28 sites in 2012). For the sites which responded, average yield\(^{13}\) per tonne of input material was 136 m\(^3\) for commercial sites (173 m\(^3\) in 2012) and 109 m\(^3\) for on-farm sites (128 m\(^3\) in 2012). Given the relatively low proportion of AD operators providing this information, this survey cannot provide a robust estimate of the total UK biogas production by AD.

Of the 88 sites surveyed, 78 sites provided information on their use of biogas (56 in 2012). Of these 92% (same as 2012) reported that their sites used biogas for on-site combined heat and power (CHP) including electricity generation and 5% reported generating heat (boiler only). A single site reported exporting biogas this year although it is likely that the two sites which reported exporting last year are continuing to do so. No sites reported using biogas as a vehicle fuel.

Three sites flared excess biogas, of between 8% and 30% of their total biogas output. The site flaring 30% of its biogas was an industrial site using AD to process large volumes of liquid and discharging to sewer. For almost all sites (other than those industrial sites which discharge to sewer), almost 100% of the gas produced was used for on-site CHP.

Respondents were also asked how much of their heat they exported, and if this was less than 100% what the remainder was used for. A total of 70 (56 in 2012) sites responded, of which only 2 reported 100% export. The majority (60 v 48 2012) reported no export of heat, citing on-site use (for instance pasteurising waste or heating digesters) and exhaustion to atmosphere (of up to 70-80% of the heat produced for some sites). The remaining 8 sites reported export levels that ranged from 10% to 90%.

3.6.2 Electricity

Operators were asked for the electricity output of their facilities in MWh. A total of 460 GWh was reported by 64 facilities ie. an average of 7 GWh per facility. Operators were also asked how much of this output was exported – responses varied from 0 (i.e. all used on site) to 100%, with an average from 66 responses of 62%.

Given the relatively low proportion of AD operators providing this information, this survey cannot provide a robust estimate of the total UK electricity generation by AD. The latest DECC report on renewable energy generation gives a figure of 707 GWh generated by AD in 2013, an increase of 42% on 2012\(^{14}\).

\(^{13}\) The Wales Centre of Excellence for Anaerobic Digestion quotes a typical range of 70-170 m\(^3\) biogas per tonne of waste input for AD operations.

\(^{14}\) https://www.gov.uk/government/statistics/energy-trends-section-6-renewables
3.6.3 Digestate

75 AD sites provided information on the quantity of digestate produced in 2013 (53 for 2012) and their total reported output was 4.3 million tonnes of digestate. Of this, 700kt was produced by commercial facilities, 510kt by on-farm, 410kt by industrial, 30kt by demonstration and 2,650kt by industrial sites which process large volumes of liquid and discharge to sewer. The average ratio of output to input has been calculated where both figures were reported, as follows: commercial sites 0.82 (26 sites), industrial sites 0.82 (5 sites), on-farm sites 0.87 (31 sites). The average ratio of output to input for industrial sites discharging to sewer was 1.0 (5 sites).

Excluding the industrial facilities that discharge to sewer and grossing for sites not supplying output data, gave a total market estimate of 2.12 million tonnes of digestate, compared to 1.44 million tonnes in 2012, as shown in Table 3.

3.6.4 Processing of digestate

Of a total of 96 sites (60 in 2012) responding, 39 sites reported that they processed their digestate further after digestion. Of these, 23 used some form of separation (19 with a press, 4 with a centrifuge), 5 used screening alone, 1 used composting alone. This compares to 21 sites that reported using separation in 2012 – 12 used a press, 7 used a centrifuge, 1 a foam screen separator and 1 a gravity screen.

In addition, in 2013 one commercial site reported using pasteurisation post processing, and one on-farm site reported adding water to the final whole digestate.

Table 17: Processing of digestate by AD site classification, % of responding sites UK 2013

<table>
<thead>
<tr>
<th>% Processing Digestate</th>
<th>Processing Technique</th>
<th>Method of separation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Commercial</td>
<td>48%</td>
<td>5 screened</td>
</tr>
<tr>
<td></td>
<td></td>
<td>7 separated</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1 pasteurised</td>
</tr>
<tr>
<td>Demonstration</td>
<td>17% (single site)</td>
<td>Various techniques tested</td>
</tr>
<tr>
<td>Industrial</td>
<td>43%</td>
<td>2 separated</td>
</tr>
<tr>
<td>Industrial – discharging to sewer</td>
<td>0%</td>
<td>-</td>
</tr>
<tr>
<td>On-Farm</td>
<td>45%</td>
<td>14 separated</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1 composted</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1 dilution</td>
</tr>
</tbody>
</table>

|                         |                      | 2 centrifuge         |
|                         |                      | 13 press             |

No further (tertiary) treatment of either the fibre or liquor following separation was reported by the 45 sites answering this question.

Of the 23 sites that reported separating fibre, an average weight of 3,500 tonnes per site was reported (2,100 in 2012). This was due to a single farm site which did not report in 2012 reporting the separation of >30,000 tonnes of fibre in 2013. For liquor, the site average was 14,500 tonnes (18 sites).
3.6.5 End Use of Products

Respondents were asked about the destinations for their outputs. A total of 74 operators responded to this question.

For whole digestate, the destinations varied depending upon the facility type. For instance, for on-farm facilities the vast majority of whole digestate was used on site by the operator’s business (92% of total), with the rest provided free of charge (FOC) to off-site users. For commercial sites, only 19% of the reported tonnage was sold to users off site, with 27% provided FOC and 26% removed at a cost to the operator. For most (44% of total reported) of the whole digestate produced by industrial sites (which excludes those discharging to sewer) the operator needed to pay the user to remove it; 33% was supplied FOC and 23% was sent to sewer. Destinations for whole digestate are summarised in the table below:

**Table 18: Whole digestate destinations per AD facility type (as reported tonnages and number of sites reporting), UK 2013**

<table>
<thead>
<tr>
<th>Destinations</th>
<th>Commercial</th>
<th>Industrial</th>
<th>On-Farm (*)</th>
<th>Number of sites responding</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sold - off site</td>
<td>90,000</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Provided F.O.C. - users off site</td>
<td>140,000</td>
<td>20,000</td>
<td>20,000</td>
<td>3 3 1</td>
</tr>
<tr>
<td>Operator paid user to remove</td>
<td>130,000</td>
<td>30,000</td>
<td>(*)</td>
<td>5 2 1</td>
</tr>
<tr>
<td>Used by own business</td>
<td>140,000</td>
<td></td>
<td>290,000</td>
<td>6 23</td>
</tr>
<tr>
<td>Disposed – landfill</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Disposed – sewers</td>
<td></td>
<td>20,000</td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>Other</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Totals</strong></td>
<td><strong>500,000</strong></td>
<td><strong>60,000</strong></td>
<td><strong>320,000</strong></td>
<td><strong>16 6 26</strong></td>
</tr>
</tbody>
</table>

**Notes:**
All tonnage figures are rounded to the nearest 10,000, (*) represents figures less than 5,000 tonnes.
Excludes industrial sites which discharge to sewer

For commercial sites, compared to data for 2012, less was sold off site or provided FOC while the proportion for which the operator had to pay for removal increased from 19% to 26%. The proportion used by the operator’s own business remained static at 28%.

For on-farm facilities, the proportion used by the operator’s own business was substantially higher in 2013.

For the small subset of sites which separated the whole digestate into fibre and liquor, information on destinations was also obtained. Of the fibre, a majority (44%) was used on site by the operating business, down from 60% in 2012. In addition 24% was sold to off-site users and for 29% the operator had to pay the user for removal. In contrast to the previous year, only 1% of the fibre reported was landfilled, compared to 33% in 2012.

For separated liquor, the majority (95%) relates to sites at drinks manufacturers and similar industrial effluent treatment sites and was disposed of via the sewer. The majority of the separated liquor produced by other types of sites was used on the operator’s own site (140,000 tonnes).
Breaking these figures down by output type is summarised in the following figure:

**Figure 13: Product End Destination by Product Type, UK 2013**

Where there was digestate that had not been disposed of to landfill or sewers, operators were asked where the digestate that they produced that was used (i.e. not disposed of to landfill or sewers) was applied. Of the 1.18 million tonnes reported, including a small quantity from sites that primarily discharge to sewer, 98% went to agriculture (mostly whole digestate and liquor) an increase on the 90% reported in 2012. Small tonnages were reported for other applications as summarised in the following table.

**Table 19: Digestate applications per AD facility type (reported tonnages), UK 2013**

<table>
<thead>
<tr>
<th>Application</th>
<th>Agriculture</th>
<th>Field-grown horticulture</th>
<th>Landfill restoration</th>
<th>Energy Recovery</th>
<th>Other</th>
</tr>
</thead>
<tbody>
<tr>
<td>Commercial</td>
<td>640,000</td>
<td></td>
<td></td>
<td></td>
<td>(*)</td>
</tr>
<tr>
<td>Demonstration (R&amp;D)</td>
<td>10,000</td>
<td>(*)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Industrial</td>
<td>40,000</td>
<td></td>
<td></td>
<td>20,000</td>
<td></td>
</tr>
<tr>
<td>On-farm</td>
<td>430,000</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Total tonnes (reported)</strong></td>
<td>1,130,000</td>
<td>(*)</td>
<td>10,000</td>
<td>20,000</td>
<td>(*)</td>
</tr>
<tr>
<td><strong>Application % of total</strong></td>
<td>97%</td>
<td>0%</td>
<td>1%</td>
<td>2%</td>
<td>0%</td>
</tr>
</tbody>
</table>

(*) represents figures below 5,000 tonnes as all figures are rounded to the nearest 10,000

Note: the number of sites reporting applications to anything other than agriculture is very small.
3.6.6 Prices

Most operators surveyed cited commercial confidentiality as a reason for not giving digestate selling prices. Only a small number of sites responded. Because of the low response, the following figures can only be indicative.

As shown in Table 18 many respondents reported that they were supplying material free of charge or having to pay for it to be used. Of those respondents who claimed to be selling digestate to off-site users, most were unwilling to disclose selling prices. For the small number that did respond, prices for digestate used in agriculture ranged from a £13 cost to the operator to a £3 selling price, with an overall average of £3.73 per tonne cost (5 respondents) compared to £0.44 cost in 2012. For other applications (horticulture, landscaping, fuel for energy) only single selling prices were received and so cannot be presented without risking the disclosure of company-specific information.

3.6.7 PAS 110

Respondents were asked for the PAS 110 status of their outputs. Of the 88 sites that responded, 21 said that their current outputs were PAS 110 certified\(^{15}\). This compares to 10 of the 59 responding in the 2013 survey. Of these 21, 16 reported that PAS 110 certification covered all their outputs (9 in the 2013 survey) and 1 site said that certification covered just the liquid output produced. All responding sites said they would renew their certification. More complete information on certified outputs and sites is available from the certification body (Renewable Energy Assurance Ltd). The main purpose of these questions was to track attitude to PAS110 in the sector.

Of those that reported that their outputs were not certified, 20 reported that they intended to obtain PAS 110 certification (13 in the 2013 survey). These sites reported processing 1.15 million tonnes and producing 1.05 million tonnes of whole digestate in 2013 but it should be noted that this included one large industrial site which discharges to sewer.

Because of AD operators’ unwillingness to disclose selling prices (costs), it is not possible to compare the value of PAS certified digestate to uncertified material.

For those who did not intend to obtain PAS 110, Table 20 summarises the reasons offered (32 responses). For the 22 sites reporting that PAS 110 is not required, 5 are industrial facilities sending their digestate to sewer, and 15 are on-farm. Of these on-farm facilities 13 use their own digestate.

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\(^{15}\) Note this figure is higher than that reported by the certification body, see [http://www.biofertiliser.org.uk/members](http://www.biofertiliser.org.uk/members), suggesting some misunderstanding of PAS certification.
Table 20: Reasons cited for not pursuing PAS 110 certification, 2013

<table>
<thead>
<tr>
<th>Reason Cited</th>
<th>No of Responses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Not required</td>
<td>22</td>
</tr>
<tr>
<td>Cost</td>
<td>3</td>
</tr>
<tr>
<td>Digestate going to own land</td>
<td>2</td>
</tr>
<tr>
<td>Do not produce any/ enough digestate</td>
<td>2</td>
</tr>
<tr>
<td>Too much hassle</td>
<td>1</td>
</tr>
<tr>
<td>Applied for an exemption</td>
<td>1</td>
</tr>
<tr>
<td>Not using non-farm waste</td>
<td>1</td>
</tr>
</tbody>
</table>

3.7 Site Employees

Sites contacted were asked for the total number of employees involved in the AD operation, as full time equivalents (FTE). The collected survey data identified 343 staff employed at the 87 sites that reported data (228 staff at 56 sites for 2012). Grossing these figures for the UK market as a whole (i.e. compensating for those sites where employee data was not collected) gave a UK total employment figure of 482 compared to 354 in 2012 i.e. a 36% increase.

Figure 13 illustrates that most AD sites employed 5 or fewer FTE employees (78% of the sites surveyed v. 71% in 2012). Fifteen sites reported largely automated facilities employing less than 1 FTE in monitoring and loading. A single site reported employing 20.

Figure 14: Employment bands for UK AD sites, as % of all responses (2013 v 2012, as full time equivalents)
3.8 Business Issues

Respondents to the survey were asked the extent to which a number of specified business issues affected their operation, those issues being:

- Storage for digestate;
- Markets for digestate;
- Making the most of the heat produced; and
- Competition for feedstocks.

The responses from those 85 facilities that responded to these questions are presented in Figure 14. The two factors which respondents saw as having greatest impact were the same in 2013 as 2012, but there have been changes in the pattern of responses.

Making the most of heat produced was cited by 39% of respondents as having either a “great” or “some” impact, down from 45% in 2012, and storage for digestates cited by 43% as having either a “great” or “some” impact, was down from 59% in 2012. Responses from four on-farm facilities noted that digestate storage had never been a problem in the past but because of the recent wet weather they could not get onto the fields and therefore needed to store digestate for longer periods.

In contrast, competition for feedstock was cited by 38% of respondents as having either a “great” or “some” impact, up from 29% in 2012. Similarly for markets for digestates, 28% of respondents cited this factor as having either a “great” or “some” impact, up from 24% in 2012. As might be expected, two respondents saw this as more of an issue in the winter than the summer.

![Figure 15: The extent to which specified business issues affect AD operations, UK 2013 v. 2012](image-url)
Sites were also asked whether they had any other comments to make about opportunities or issues for their businesses.

A range of opportunities were cited, with the most common themes being the use of heat, the potential for growth and greater awareness of the technology.

The issues cited included two of the factors in the previous question (storage for digestate – typically in the context of the wet weather – and competition for feedstock). Others raised issues around the investment climate, contamination of feedstock and variations in the renewable energy tariffs as well as regulatory scrutiny.

3.9 RIDDOR Accidents

Sites were also asked if there had been any RIDDOR (Reporting of Injuries, Diseases and Dangerous Occurrences Regulations 2013) accidents at their AD plants in 2013. Of the 85 sites responding, four reported such instances. Three of these were commercial facilities, and one an on-farm facility.

4. Conclusions

The continued growth of the AD sector is reflected in the significant increase in the total number of operational facilities in three of the nations of the UK between the last survey for 2012 and this survey for 2013. England saw 20 additional sites, Wales 4 and Northern Ireland 6 (none in Scotland) giving a UK total of operating sites in 2013 of 117, compared to 87 in 2012. In total 88 sites were surveyed for 2013 compared to 61 in 2012, giving an increased participation rate and making this the most robust survey of the AD sector to date.

The grossing of input tonnage figures provided by the sites which were surveyed, to fill gaps for those sites which did not supply data, and excluding industrial sites which treat large volumes of liquid effluent and discharge to sewer, gives a UK AD sector input estimate for 2013 of 2.55 million tonnes (compared to 1.69 million tonnes in 2012), an increase of 51% on the previous year. Similarly grossed figures for operating capacity gave a total of 3.2 million tonnes (v. 2.0 million tonnes in 2012), a 55% increase on 2012 and implying an 80% utilisation, similar to last year.

It is estimated that the industrial sites co-located with drinks manufacturers, that process large volumes of liquid effluent and discharge to sewer, amount to an additional 7.5 million tonnes input.

Of the inputs, 38% by weight was separated solid food, 30% liquids and 31% agricultural materials – such as purpose grown crops and manures. Excluding purpose grown crops and manures, 19% of these inputs came from local authority collections, 8% from supermarkets, 2% from the hospitality sector, 4% agricultural waste with the majority of the balance coming from food manufacturing (66%).

In terms of outputs, grossing for sites not supplying output data but excluding those industrial facilities that discharge to sewer, gave an estimate of 2.12 million tonnes of all outputs, compared to 1.44 million tonnes in 2012. This is an increase of 47%. Of the
digestate tonnage reported, 98% was used in agriculture (mostly whole digestate and liquor).

Many respondents reported that they were supplying material free of charge or having to pay for it to be used. Of those respondents who claimed to be selling digestate to off-site users, most were unwilling to disclose selling prices. For the small number that did respond, prices for digestate used in agriculture ranged from a £13 cost to the operator to a £3 selling price, with an overall average of £3.73 per tonne cost (5 respondents) compared to £0.44 cost in 2012. For other applications (horticulture, landscaping, fuel for energy) only single selling prices were received.

Respondents were asked for the PAS 110 status of their outputs. All of the sites that said that their current outputs were PAS 110 certified said they would renew their certification. Of those that reported that their outputs were not certified, 20 reported that they intended to obtain PAS 110 certification (13 in 2012).

Operators were asked about the impact of specific issues on their own businesses. Making the most of heat produced was cited by 39% of respondents as having either a “great” or “some” impact, down from 45% in 2012, and storage for digestates cited by 43% as having either a “great” or “some” impact, was down from 59% in 2012. However, responses from four on-farm facilities noted that digestate storage had never been a problem in the past but because of the recent wet weather they could not get onto the fields and therefore needed to store digestate for longer periods. Competition for feedstock was cited by 38% of respondents as having either a “great” or “some” impact, up from 29% in 2012. Similarly for markets for digestates, 28% of respondents cited this factor as having either a “great” or “some” impact, up from 24% in 2012. As might be expected, two respondents saw this as more of an issue in the winter than the summer.

Asked for any other opportunities and threats to their businesses, respondents nominated a number of positives such as use of heat, the potential for growth and greater awareness of the technology. The negatives raised included the investment climate, contamination of feedstock, variations in the renewable energy tariffs and regulatory scrutiny.
### Appendix 1 - Glossary

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>ADBA</td>
<td>Anaerobic Digestion and Biogas Association</td>
</tr>
<tr>
<td>AfOR</td>
<td>Association for Organics Recycling (now merged with REA – see ORG, below)</td>
</tr>
<tr>
<td>Anaerobic digestion (AD)</td>
<td>Process of controlled decomposition of biodegradable materials under managed conditions where free oxygen is absent, at temperatures suitable for naturally occurring mesophilic or thermophilic anaerobic and facultative bacteria species that convert the inputs to biogas and whole digestate.</td>
</tr>
<tr>
<td>Commercial AD Facility</td>
<td>Site which accepts waste from off-site, on a commercial basis (i.e. for a gate fee). May be a farm based enterprise</td>
</tr>
<tr>
<td>Confidence interval (CI)</td>
<td>Defines the error bands around a statistic. A 90% CI around a sample average indicates that in 9 cases out of 10 the band includes the average for the whole population from which the sample was drawn (assuming the statistical model used to construct the CI is valid).</td>
</tr>
<tr>
<td>Demonstration AD Facility</td>
<td>Demonstration/R&amp;D site. AD sites that process feedstock for demonstration or feasibility purposes. Such sites may contract in waste but not on a large scale</td>
</tr>
<tr>
<td>Digestate</td>
<td>Digestate is the residue resulting from the anaerobic digestion of biodegradable materials. Whole digestate may be separated into liquor and fibre fractions.</td>
</tr>
<tr>
<td>EA</td>
<td>Environment Agency</td>
</tr>
<tr>
<td>Industrial AD Facility</td>
<td>Site which processes their own wastes, typically on a large scale, such as food and drink manufacturers</td>
</tr>
<tr>
<td>Mechanical biological treatment (MBT)</td>
<td>A generic term for an integration of several processes treating mixed wastes, such as Materials Recovery Facilities, sorting and composting or AD.</td>
</tr>
<tr>
<td>NIEA</td>
<td>Northern Ireland Environment Agency</td>
</tr>
<tr>
<td>On-Farm AD Facility</td>
<td>Site which is both located on a farm and processes only material generated on-farm (including energy crops)</td>
</tr>
<tr>
<td>ORG</td>
<td>The Organics Recycling Group. A section within the REA which represents the membership of the former AfOR.</td>
</tr>
<tr>
<td>Organic waste</td>
<td>Waste of animal or plant origin which, for recovery purposes, can be</td>
</tr>
</tbody>
</table>
decomposed by micro-organisms, other larger soil-borne organisms or enzymes.

**PAS 110**
Publicly Available Specification 110, which is the British Standards Institution’s specification for whole digestate, separated liquor and separated fibre derived from the AD of source-segregated biodegradable materials, published in February 2010.

**Permitted/exempt waste operation**
A permitted waste operation is one which is subject to the granting of an Environmental Permit. This is a permit granted by the regulator allowing the operation of a regulated facility subject to certain conditions.

An Exempt waste operation is a waste operation exempt from the need to hold an environmental permit where it meets certain criteria. Exemptions include:
- **T23** - Aerobic composting and associated prior treatment e.g. an allotment association wants to compost their old plants and trimmings.
- **T24** - Anaerobic digestion at premises used for agriculture and burning of resultant biogas eq. anaerobically digest manure and plant tissue waste in a dedicated AD plant to produce a digestate.

**REA**
Renewable Energy Association

**SEPA**
Scottish Environment Protection Agency

**Source-segregated feedstock**
Feedstock kept separate from other waste types so as to reduce contamination and facilitate treatment. It is referred to as ‘separate collection’ in the Waste Framework Directive (2008/98/EC).

**Unit of mass**
Expressed in metric tonnes (t) = 1,000kg
1 kt = 1000 tonnes
1 Mt = 1 million tonnes = 1,000,000 or $10^6$ tonnes

**Unit of volume**
Expressed in metres cubed ($m^3$), which is equivalent to 1,000 litres.

**Unit prefixes**
SI units and prefixes have been used:
- k (kilo) = 1,000
- M (mega) = 1,000,000
Appendix 2 – Survey Methodology

This research focuses on the calendar year 2013 and follows on from the 2012 survey, which was delivered in 2013 by the same project team. The surveys of 2009 and 2010 (delivered in 2011 and 2012) used an approach which relied on regulatory returns for input data which only become available 11-15 months after the year in question. This year, as in 2013, rather than have this significant time lag between the survey and the year in question, the survey for 2013 was started soon after the end of the calendar year, and respondents were asked to provide input tonnage figures.

Review of previous survey and impact on employed methodology

The 2013 survey used the same core delivery methodology as that delivered in 2012 so that the successful results of 2012 could be reproduced and built on, and so that data from 2013 and 2012 could be directly compared.

The questionnaires used for this survey were based upon those employed in 2012, although in some areas additional questions were included to broaden the amount of useful data collected. The survey was delivered by BDS Marketing Research Limited who have experience of collecting data from the AD sector for updating of the AD Information Portal map.

Development of contacts database

For the AD operators survey, the list of AD facilities collated for the AD Information Portal map (http://www.biogas-info.co.uk/index.php/ad-map.html) was used.

Marketing

The survey was publicised by steering group members ADBA, REA and ESA, to their memberships. In addition, news releases were prepared and these were distributed by WRAP. The ESA also helped engage multi-site operators with the survey. The aim of marketing the work was to heighten awareness of the survey in the industry so that when approached to take part individuals already had some knowledge of the research. A page was also established on the WRAP website with information on the survey; this provided details of the work and also served to validate the research for any contacts that required it.

Questionnaire development

The questionnaire design was based upon the following requirements:

- to provide the data required for the survey and to resist adding additional “nice to have” requests for data which would lengthen the interviews;
- to minimise the impact on the interviewee, particularly in terms of the time taken to deliver the survey; and
- to maintain consistency with the questionnaire used for the last survey, so that key data could be compared.

Once an initial draft of the questionnaire was formulated it was circulated to the steering group and feedback and comments incorporated.
Site Survey

The final version of the questionnaire was provided to BDS as a Word document, with an accompanying set of briefing notes. The questionnaire was reproduced by BDS Marketing Research Ltd as an MS Excel spreadsheet, which was used to collect the survey responses.

For the survey, site operators were contacted by telephone by the surveyors, and the responses to the survey entered directly into the structured spreadsheet. Interviewing took place between 17th February and 18th April 2014.

Data confidentiality

In order to ensure the confidentiality of the data provided by respondents, site details were stored separately to survey answers. A unique site identification code links the two datasets. This unique code dataset was only available to those members of the survey team who needed access for data checking and other purposes.

Quality checking

The BDS Director responsible for the survey checked data from the surveyors as it was returned, and some anomalies were referred back to the respondents, during the fieldwork period.

During data analysis, any items that appeared anomalous were identified (e.g. sense checked against other data collected and against the 2012 survey) and then checked, if required, directly with the site by phone and corrected where necessary.

The high participation rates achieved and the extensive quality checking imposed on the collected data, means the project team has a high level of confidence in the data collected and in the results generated from this data.

Data analysis

After quality checks, the collected data was analysed by waste management method and UK nation, using the following methods:

- Grossing of the collected quantitative data was carried out to take account of those companies which did not take part in the interview. The methodology used is explained in detail in Appendix 3, and was the same as that employed in the 2012 survey so that results could be compared.
- Distribution plots were produced to represent the spread of responses to questions such as selling prices of outputs, to indicate precision.

Key data is further analysed, extrapolated and presented in the body of this report.
Appendix 3 - Grossing Methodology

This survey has adopted the same grossing methodologies as the 2012 survey, described below, for site inputs, capacities, outputs and employee numbers. This enables the results for 2012 and 2013 to be directly compared. This method was based on the ratios of capacity to input, and input to outputs. However, for AD employee numbers a stratified grossing methodology was used, as for the 2012 and 2010 surveys. This was because no consistent ratio of either input or capacity to employee numbers per site was found in the survey responses.

Grossing of Survey Tonnage Data

In this (2013) survey, as in 2012, the decision was taken to include all AD apart from waste water treatment sites and those which process only organic output from MBT. In order to achieve a sensible grossing up, the AD sites were categorised by type of facility using the following classifications, based on categories held in the database which underpins the AD Portal map:

- Commercial – sites which accept waste from off-site, on a commercial basis (i.e. for a gate fee). May be a farm based enterprise
- Industrial – sites which process their own wastes, typically on a large scale, such as food and drink manufacturers.
- On-farm – sites which are both located on a farm and process only material generated on-farm (including energy crops)
- Demonstration – demonstration/R&D sites. May contract in waste but not on a large scale

For the calculation and reporting, industrial sites were separated into two categories:

- Those processing large volumes of liquid and discharging to sewer (9 sites surveyed of the 15 sites in the population). These are typically breweries and distilleries with inputs >500,000tpa.
- Those similar to commercial sites with inputs <300,000 and producing a digestate for market.

To provide estimates of input, operating capacity and digestate where the data was not available from the survey, ratios were used to calculate figures to fill gaps in the survey data. The ratios used are shown in Table 21, alongside those generated for the 2012 survey, for comparison. Where there are blanks, there was survey data for all the sites and so no need for grossing up.

In calculating these ratios, sites with a permitted capacity of 74,999 tonnes but significantly different operating capacity were excluded, since it was clear that their permitted capacity reflected waste permitting cost banding rather than facility size. Also sites that were operational for part of 2013 were excluded from the calculation of ratios, although they were included in the estimations of the overall tonnages. These same exclusions were used in the 2012 survey.
Table 21: Ratios used for tonnage grossing calculations 2013 and 2012

<table>
<thead>
<tr>
<th>Type</th>
<th>2013</th>
<th>2012</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Average Ratio</td>
<td>Average Ratio</td>
</tr>
<tr>
<td></td>
<td>(permitted capacity:input)</td>
<td>(input:output)</td>
</tr>
<tr>
<td>Commercial</td>
<td>1.444</td>
<td>1.435</td>
</tr>
<tr>
<td>Demonstration/R&amp;D</td>
<td>1.261</td>
<td>1.020</td>
</tr>
<tr>
<td>Industrial</td>
<td>1.482</td>
<td>1.194</td>
</tr>
<tr>
<td>Industrial to sewer</td>
<td>1.421</td>
<td>1.000</td>
</tr>
<tr>
<td>On-Farm</td>
<td>1.200</td>
<td>1.148</td>
</tr>
</tbody>
</table>

To estimate inputs for sites where there was no input data, the average permitted capacity to input (permitted capacity:input) ratio for each site type was calculated by using data for the surveyed sites that had both permitted capacity and input data. The type-specific ratios were then applied to the sites where there was permitted capacity data but no input data, according to site type.

To estimate operating capacity for sites where there was no operating capacity data, the permitted capacity data was used as the operating capacity. For sites with neither permitted capacity nor operating capacity data, the permitted capacity was estimated using the average permitted capacity:input ratios derived as described above.

To provide an estimate of digestate produced for sites where there was no data, the average input to digestate output (input:output) ratio for each site type was calculated by using surveyed sites that had both input and digestate data. The type-specific ratios were then applied to the sites where there was input data but no digestate data, according to site type.

The grossed UK figures therefore represent the summation of all the figures provided by survey respondents plus the estimated figures for sites where data was not available.

**Grossing of Employment Data**

The methodology used for estimating total employment involved extrapolating survey data from sites which did provide data to produce estimates for those sites which did not provide data, so that estimates of the total employment at both a sector wide and national level could be made. The methodology is the same as was used for the 2010 and 2012 surveys, and was executed on a “banding” basis to take into account variation between sites. The employee number bands used in the grossing are sufficiently narrow and the assumption made is that the sample average employment per site for each band is representative of the population (i.e. total sites: surveyed plus not surveyed) in that band.

Firstly, bands were established and the number of sites that provided employment data in the 2013 survey was tabulated by employment band. The total employment figure for each of the bands was determined by summing the data for the sites in each band. The average number of employees per site for each band was then calculated by dividing the total number of employees in that band by the number of sites in that band which provided employment data – see Table 22.
The proportion of sites with employment data in each band was calculated by dividing the total number of sites with data in that band by the overall total number of sites surveyed. This proportion was then applied to the total number of sites without data. An estimate of the total number of sites in each band (i.e. total sites with and without data) was then determined by adding the number of sites in the band that provided employment data to the estimated number of sites in the band without data – see Table 23.

The estimated number of sites in each employment band was then multiplied by the average number of employees per site for each band to estimate the total number of employees for each band and hence the overall/total number of employees.

It should be noted that this grossing process implicitly assumes uniform sampling and so is liable to over emphasise the significance of activities where a higher than average proportion of the total has been surveyed.
Table 22: AD employment – Employment categories employed using actual survey data

<table>
<thead>
<tr>
<th>Employment categories</th>
<th>Number of sites (with employment data)</th>
<th>Total Number of Employees</th>
<th>Average Employment</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-2</td>
<td>37</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>3-5</td>
<td>15</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>6-8</td>
<td>8</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>9-11</td>
<td>1</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>&gt;11</td>
<td>5</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>66</strong></td>
<td><strong>7</strong></td>
<td><strong>6</strong></td>
</tr>
</tbody>
</table>

Table 23: AD employment – grossing employment based upon calculated totals for all operational sites

<table>
<thead>
<tr>
<th>Employment categories</th>
<th>Proportion of sites in each category</th>
<th>Number of sites in each category (from those without employment data)</th>
<th>Total Number of operational sites in each category</th>
<th>Grossed up employment</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-2</td>
<td>56.1%</td>
<td>42.9%</td>
<td>66.7%</td>
<td>87.5%</td>
</tr>
<tr>
<td>3-5</td>
<td>22.7%</td>
<td>0.0%</td>
<td>16.7%</td>
<td>12.5%</td>
</tr>
<tr>
<td>6-8</td>
<td>12.1%</td>
<td>14.3%</td>
<td>16.7%</td>
<td>0.0%</td>
</tr>
<tr>
<td>9-11</td>
<td>1.5%</td>
<td>28.6%</td>
<td>0.0%</td>
<td>0.0%</td>
</tr>
<tr>
<td>&gt;11</td>
<td>7.6%</td>
<td>14.3%</td>
<td>0.0%</td>
<td>0.0%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>100%</strong></td>
<td><strong>100%</strong></td>
<td><strong>100%</strong></td>
<td><strong>100%</strong></td>
</tr>
</tbody>
</table>
Appendix 4 – Survey Questionnaire

Instructions for the telephone surveyors are given in red.

Annual Survey of the UK Organics Recycling Industry 2013

AD Site (EXCLUDING SEWAGE TREATMENT and MBT AD)

Check first that the site does NOT:

Process only sewage/water treatment
Process only mixed waste ('black bag' waste)

Both of these types of sites should be excluded – inform WRAP of any such sites on the list

<table>
<thead>
<tr>
<th>Name</th>
<th>Telephone</th>
</tr>
</thead>
<tbody>
<tr>
<td>E-mail</td>
<td>Title</td>
</tr>
<tr>
<td>Company Name</td>
<td>Company Postcode</td>
</tr>
<tr>
<td>Site Name</td>
<td>Site Postcode</td>
</tr>
</tbody>
</table>

Type of Facility

SIMPLY CHECK THIS AGAINST ANSWERS TO PREVIOUS SURVEY – IF AVAILABLE

Q1. When did the site become operational? (Please write in MM/YYYY) ______/_____

Q2a. Did this site operate under a permit or an exemption during 2013?  Permitted  Exempt

If site operated under a permit in 2013:

Q2b. In 2010 was this site operating under a permit or an exemption?  Permitted  Exempt

Q3. How many people are employed on this AD plant? (expressed as FTEs) ______

Q4a. I understand that your permitted capacity was [pre-complete]. Is that correct?

If not, note correct figure, do not overwrite (make discrepancies visible)

Q4b. According to the Biogas Map your operational capacity was [pre-complete]. Is that correct?

If not, note correct figure, do not overwrite (make discrepancies visible)

Q4c. Taking into consideration planning, regulatory and physical constraints; what was the maximum working capacity of this site in 2013? ____________ tonnes per year

Q5. According to the Biogas Map your energy generation capacity was [pre-complete]. Is that correct?

If not, note correct figure, do not overwrite (make discrepancies visible)
Q6 What type of AD system was the site using during 2013?
(IF TWO OR MORE SYSTEMS OPERATING IN PARALLEL AT SITE, FILL IN SEPARATE Q’RE FOR EACH, TO ENSURE NO DOUBLE-COUNTING)

Q6a AD system type
- [] Single stage
- [ ] Two-stage

Q6b AD system type
- [ ] Continuous
- [ ] Batch (“Plug flow”)

Q6c AD system type
- [ ] Wet
- [ ] Dry

Q6d AD system type
- [ ] Mesophilic
- [ ] Thermophilic

Q6e Hydraulic retention time
- [ ] days

Q7 Were you using pasteurisation?
- [ ] Yes (Please go to Q7a)
- [ ] No (Please go to Q8)

Q7a IF YES, was it...?
- [ ] Pre digestion
- [ ] Post digestion

Q8 Aside from pasteurisation, what types of pre-processing of feedstocks was carried out on this site in 2013? (Please tick all that apply)
- [ ] Screening
- [ ] Hand picking
- [ ] Pulping (e.g. screw or hydropulper)
- [ ] Shredding
- [ ] De-packaging*
- [ ] Blending / mixing
- [ ] Other (Please specify )

*INTERVIEWER NOTE: INCLUDES REMOVAL OF CADDY-LINERS, IF RELEVANT

Q8a Do you have anything in place to mitigate odours from your plant?
- [ ] Yes
- [ ] No

Feedstocks

Q9 How much of your feedstocks in 2013 were: READ OUT TYPE AND ENTER QUANTITY IN TONNES.
CONFIRM THAT THE SUM OF THE FIGURES GIVEN EQUALS THE TOTAL INPUT IN 2013
Q10. FOR ALL BUT THE FIRST 2 TYPES PROCESSED, ASK: What proportion of your (TYPE) feedstock came from each of the following sources: READ OUT SOURCE AND ENTER PERCENTAGE. IF USING ‘OTHER’ ENSURE THAT YOU RECORD A DESCRIPTION OF WHAT ‘OTHER’ IS

<table>
<thead>
<tr>
<th>SOURCE (percentages)</th>
<th>QUANTITY (tonnes)</th>
<th>Local Authority collections</th>
<th>Agriculture</th>
<th>Supermarkets /Retail</th>
<th>Hospitality sector</th>
<th>Food manufacturers/processors</th>
<th>Other source (specify)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Purpose grown (energy) crops</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Manures/ slurries</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Food (solid)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Liquids</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mixed food and green material</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other type of material (specify)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TOTAL</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>INTERVIEWER CHECK = TOTAL INPUT AT THIS SITE IN 2013</td>
</tr>
</tbody>
</table>

Q11a. What level of reject material do you typically find, per tonne? (INTERVIEWER: tick one)

- Less than 1%
- 1% - 5%
- 6% - 10%
- Over 10%

Q11b. Which of the sources of your feedstock was the main source of this contamination in 2013?

<table>
<thead>
<tr>
<th>Local Authority collections</th>
<th>Agriculture</th>
<th>Supermarkets /Retail</th>
<th>Hospitality sector</th>
<th>Food manufacturers/processors</th>
<th>Other source</th>
</tr>
</thead>
</table>

Q12. In 2013, approximately what percentage of your feedstock was sourced...?

- from the site at which the plant is located ____%
- from other sites within the same business (or business group) ____%
- from external sources ____%

Q13. What was the quantity of whole digestate produced in 2013?
INTERVIEWER: this relates to the overall quantity, prior to separation of liquid from fibre, if this is done.

Wet weight ________________ tonnes (interviewer: 1 m³ = 1 tonne)
Q14. Is the whole digestate processed further, after digestion?  
☐ Yes (Please go to Q14a)  ☐ No (PLEASE GO TO Q19)

Q14a. IF YES, how? (Please tick all that apply)  
☐ Screened to remove contaminants  ☐ Pelletised  
☐ Composted  ☐ Other (Please specify below)  
☐ Separated into fibre & liquor

IF WHOLE DIGESTATE WAS NOT SEPARATED INTO FIBRE AND LIQUOR, PLEASE GO TO Q19

Q15. How was the digestate separated into fibre and liquor? (Please tick all that apply)  
☐ Centrifuged  
☐ Press  
☐ Other (Please specify below)

Q16. What was the quantity of separated fibre produced in 2013?  
Wet weight ___________ tonnes

Q17. And what was the quantity of separated liquor? ___________ tonnes  
INTERVIEWER INSTRUCTION: If quantity of liquor is given in volume (cubic metres), assume 1m³ = 1 tonne

Q18. Do you apply any further processing after separation  
☐ Yes  ☐ No

Q18a. IF YES, What? ___________________________________________
### Use of Products – whole digestate OR fibre and liquor

**Q19.** How much of the digestate that you produced in 2013 went to each of the following destinations?

<table>
<thead>
<tr>
<th>Destination</th>
<th>Whole</th>
<th>OR</th>
<th>Fibre</th>
<th>Liquor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sold to users off –site</td>
<td>_____</td>
<td></td>
<td>_____</td>
<td>_____</td>
</tr>
<tr>
<td>Provided Free of Charge to users off-site</td>
<td>_____</td>
<td></td>
<td>_____</td>
<td>_____</td>
</tr>
<tr>
<td>(includes charged for transport but not product)</td>
<td>_____</td>
<td></td>
<td>_____</td>
<td>_____</td>
</tr>
<tr>
<td>Site operator paid user to remove</td>
<td>_____</td>
<td></td>
<td>_____</td>
<td>_____</td>
</tr>
<tr>
<td>Used by your own business</td>
<td>_____</td>
<td></td>
<td>_____</td>
<td>_____</td>
</tr>
<tr>
<td>Disposal to landfill</td>
<td>_____</td>
<td></td>
<td>_____</td>
<td>_____</td>
</tr>
<tr>
<td>Disposal to sewers</td>
<td>_____</td>
<td></td>
<td>_____</td>
<td>_____</td>
</tr>
<tr>
<td>Other (please specify)</td>
<td>_____</td>
<td></td>
<td>_____</td>
<td>_____</td>
</tr>
</tbody>
</table>

**Q20.** Of the digestate that you produced in 2013 that was used (i.e. not disposed of to landfill or sewers), where was it applied?

<table>
<thead>
<tr>
<th>Use</th>
<th>Whole</th>
<th>OR</th>
<th>Fibre</th>
<th>Liquor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agriculture</td>
<td>_____</td>
<td></td>
<td>_____</td>
<td>_____</td>
</tr>
<tr>
<td>Field-grown horticulture</td>
<td>_____</td>
<td></td>
<td>_____</td>
<td>_____</td>
</tr>
<tr>
<td>Landscape development</td>
<td>_____</td>
<td></td>
<td>_____</td>
<td>_____</td>
</tr>
<tr>
<td>Landfill restoration</td>
<td>_____</td>
<td></td>
<td>_____</td>
<td>_____</td>
</tr>
<tr>
<td>Fuel for energy recovery</td>
<td>_____</td>
<td></td>
<td>_____</td>
<td>_____</td>
</tr>
<tr>
<td>Other (Please specify below)</td>
<td>_____</td>
<td></td>
<td>_____</td>
<td>_____</td>
</tr>
</tbody>
</table>

**Q21.** Where the outputs produced in 2013 were applied, what was the average ex-works sale price for each use?

<table>
<thead>
<tr>
<th>Use</th>
<th>Whole</th>
<th>OR</th>
<th>Fibre</th>
<th>Liquor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agriculture</td>
<td>£/T</td>
<td>£/T</td>
<td>£/T</td>
<td>£/T</td>
</tr>
<tr>
<td>Field-grown horticulture</td>
<td>£/T</td>
<td>£/T</td>
<td>£/T</td>
<td>£/T</td>
</tr>
<tr>
<td>Landscape development</td>
<td>£/T</td>
<td>£/T</td>
<td>£/T</td>
<td>£/T</td>
</tr>
<tr>
<td>Landfill restoration</td>
<td>£/T</td>
<td>£/T</td>
<td>£/T</td>
<td>£/T</td>
</tr>
<tr>
<td>Fuel for energy recovery</td>
<td>£/T</td>
<td>£/T</td>
<td>£/T</td>
<td>£/T</td>
</tr>
</tbody>
</table>
Other (Please specify below) £/T £/T £/T £/T

Outputs – Biogas

Q22a. What was the total biogas yield in 2013 (m³) ? ______________ m³

Q22b. Of the biogas that you produced in 2013, how much was used for: (WRITE IN %s)
- Heat (boiler only) %
- Heat & electricity (combined heat & power, on-site CHP) %
- Direct injection of gas into national grid %
- Vehicle fuel (e.g. RCV fleet) %
- Other (Please specify below) %

Q22c. What was the gross output of the site in 2013 (Biogas combustion on site)? __________ MWh/yr

Q22d. How much electricity was generated in 2013? __________ MWh

Q22e. How much electricity was exported? __________ % / MWh INTERVIEWER DELETE AS APPLICABLE

Q22f. Of all the heat that you generated in 2013, what proportion was exported off site? ______ %

Q22g. IF LESS THAN 100%: What was any remaining heat used for? INCLUDE WASTAGE/VENTING
_________________________________________________________________
_________________________________________________________________

Quality

Q23a. Are you currently producing digestate certified to PAS110? Yes ☐ No ☐

IF YES TO Q23a: Q23b. Do you intend to maintain your PAS certification? Yes ☐ No ☐

IF NO TO Q23a: Q23c. Do you intend to obtain PAS certification? Yes ☐ No ☐

IF NO TO EITHER Q23b OR Q23c: Q23d. Why is that?
_________________________________________________________________
_________________________________________________________________
Q24. Does the certification apply to all or only part of your output?  All ☐ Part ☐

IF PART: To which part? (form, tonnage, destination)

____________________________________________________

“Have Your Say”

Q25. For each of the following business issues, please say the extent to which it affects your AD operation – great effect, some effect, little or no effect?

<table>
<thead>
<tr>
<th>Issue</th>
<th>Great</th>
<th>Some</th>
<th>Little/none</th>
<th>Don’t know</th>
</tr>
</thead>
<tbody>
<tr>
<td>Competition for feedstocks</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Making the best use of the heat produced</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Markets for digestate</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Storage for digestate</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Q25a. Have there been any RIDDOR accidents at your AD plant in 2013? ☐ Yes ☐ No

Q26. Do you have anything further you would like to add, in terms of opportunities or issues for your business?

RECORD WHETHER THE RESPONDENT REGARDS THE ISSUE AS NEGATIVE (A “THREAT”) OR POSITIVE (AN “OPPORTUNITY”)  

Negative / Threats:  

Positive / Opportunities:  

READ OUT:

Normal practice in survey research is to ensure anonymity of responses. However, WRAP is likely to be conducting this survey again in 2015. Would you be prepared to let us pass your information to them so that it can be used to plan for that survey and analysing year-on-year changes?  IF YOU ANSWER NO, YOU ANSWERS WILL ONLY BE USED ANONYMOUSLY
Would you be happy for WRAP to use the information you have provided on your feedstocks, tonnage capacity and energy capacity to update its other information such as the database which supports the AD map and the gate fees survey? This could reduce the requests for information which you get from WRAP.

☐ Yes  ☐ No

**INTERVIEWER: NOTE ANY CAVEATS/LIMITATIONS:**

Would you be happy for WRAP sector specialists to be able to review the information that you have provided, in its entirety, in order to be able to better understand the AD sector?

☐ Yes  ☐ No

**INTERVIEWER: NOTE ANY CAVEATS/LIMITATIONS:**