

Organics recycling industry status report 2015



A report on the status of composting and Anaerobic Digestion (AD) sectors in UK (England, Wales, Scotland and Northern Ireland).

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Front cover photography: Digestate output from AD facility, taken by Lucy Hopwood, NNFCC

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Executive summary

This report provides a snapshot of the status of the UK's organics recycling industry in 2014 with additional information for 2015 where data is available. Previous analyses have used comprehensive surveying to capture deployment data and trends in composting and anaerobic digestion (AD). In contrast, this report utilises various public and commercial databases and a smaller survey to deliver a snapshot of the industry, and provides the tools and data sources to help industry to be able to track the status of the organic recycling industry in future years.

Background

The annual UK-wide organics recycling survey has been carried out since the mid-1990s and has provided invaluable data about the status of the sector and a means of monitoring its development and expansion. It has been the only source of actual capacity and throughput data for the organics recycling industry, allowing year on year development to be monitored.

As the organics recycling industry has developed and matured, its trade bodies have become experts in handling core information about the ambition, nature and capacity of the sector. Consequently, a number of different organisations now collect key data. This year is therefore a year of transition, in which the organics recycling status report is led by WRAP but is delivered in partnership with industry bodies NNFCC, ADBA, REA, ORG and ESA.

It is expected that future surveys and data collation will be led by industry.

Methodology

The majority of data presented in this report has been collated from secondary data sources, from public and commercial databases.

For the AD sector, deployment databases held by WRAP, NNFCC and ADBA were used to capture the size, capacity and expected future deployment of AD. Energy outputs were quantified using national statistics held by DECC in the central FIT and RHI registers, Energy Trends, and Digest of UK Energy Statistics (DUKES). For digestate production and use, data from REAL's Biofertiliser Certification Scheme (PAS110) was used.

For composting, data on inputs from local authorities were obtained from Waste Data Flow, and permitted input from the Environment Agency's Waste Interrogator. The size of quality compost markets were estimated using data from REAL's Compost Certification Scheme (PAS100).

Past surveys on the organics recycling industry were used to compare year on year values and to monitor longer term trends. As part of this project a short survey was conducted to fill data gaps for England and Wales. However, the response rate was too

low to be representative of the industry. Therefore this survey data was not included in the main report, and was not the primary means of data collection as in previous years.

Data from a more comprehensive organics recycling survey carried out by Zero Waste Scotland (ZWS) for 2014 and WRAP Cymru's survey of green waste compost production capacity for 2014/15, were used to evaluate the markets in Scotland and Wales respectively in more depth, and their results are summarised in this report.

Anaerobic Digestion (AD)

The AD sector has been growing at a rapid pace, from a nascent industry in 2004 with a handful of plants to becoming an established industry in 2014. In 2012, 105 AD plants processed 2.4 million tonnes of inputs with 120 MWe output capacity, and by 2014, 259 AD facilities processed 5.26 million tonnes of feedstock (with 6.57 million tonnes of operational capacity) and provided 238 MWe of generating capacity. This trend is set to continue with around 500 developments in the pipeline, to potentially double or triple the size of the sector between 2014 and 2019. However, this level of deployment is highly dependent on the policy landscape, reviewing of renewable energy incentives and access to suitable feedstocks.

The majority of feedstock processed in 2014 was food waste (1.8 million tonnes, 35%), followed by crops (1.4 million tonnes, 26%), other waste (1.1 million tonnes, 21%), manure/slurry (0.74 million tonnes, 14%), and crop waste (0.21 million tonnes, 4%). However, feedstocks varied markedly between nations, with Scotland and Wales processing more 'other wastes' (particularly industrial) and less crops, and Northern Ireland using more crops and manure, compared to England.

Local authorities sent 314,516 tonnes of food waste to AD facilities in Great Britain; 191,830 tonnes in England, 52,686 tonnes in Wales in 2014/15, and 70,000 tonnes in Scotland in 2014. Therefore, the majority (1.53 million tonnes) of food waste processed by AD facilities in England, Wales and Scotland came from commercial and industrial sources. An estimated 4.76 million tonnes of food waste are contained in domestic waste (WRAP Synthesis of Food Waste Compositional Data, 2014/15); accounting for the 314,516 tonnes already processed through AD as stated above, this leaves a major potential untapped feedstock source equating to around 4.45 million tonnes per year. This means there is great potential to increase food waste collections, to help the AD industry grow.

It is estimated that 4.5 million tonnes of digestate was produced in 2014, based on declared input volumes and typical conversion efficiencies. This was a 56% rise from 2013, where 2.89 million tonnes of digestate was estimated to be produced.

In 2014, 19 AD sites were PAS110 accredited under the Biofertiliser Certification Scheme. However, site certification has been increasing, from 10 sites in 2013 to 42 sites in 2015, suggesting markets for digestate are developing and the scheme is becoming more widely recognised. The market value for digestate has been low in past surveys (-£13 to £3 per tonne); however, as markets develop recognition of the value is expected to improve.

The number of jobs in the AD sector has been increasing, coinciding with the increase in deployment; growing from an estimated 688 jobs in 2013 to 1,007 jobs in 2014 (46% increase). The increase in employment has the potential to continue as the deployment pipeline remains strong. However, this is only a theoretical outlook, and realistically future growth is highly dependent on the policy and economic landscape.

Compost

The compost sector is more mature than the AD sector, and continues to grow albeit at a steadier rate, from 271 permitted sites in 2012, to 310 in 2014 and 330 in 2015. There were 5.85 million tonnes of organic material received by composting facilities in 2012, and 5.92 million tonnes input in 2014. Due to methodological changes, moving from a comprehensive survey to reliance on publicly available data from Local Authorities and the Environment Agency in 2014, the scale of compost production appears to be in decline. However, this is most likely due to a time-lag in recording, reporting and publishing data. In future years a more accurate picture of sector growth will be obtained, as more data is published.

In the UK, between 2007 and 2012, the majority of feedstock into the compost sector was consistently sourced from local authorities (70-88%), and consisted mainly of green waste, contributing more than 70%, and food waste. In 2014 in Scotland and Wales, the proportion of green waste was similar (>68% and >66 % respectively), and across the UK quality compost certified with PAS100 consisted of >88% green waste, with the remainder being a mix of food waste and green waste. It is difficult to estimate the amount and source of inputs other than from local authorities, as the Environment Agency Waste Interrogator data is not complete (261 permitted sites detailed out of an estimated 310 in 2014).

Historically, the largest market for compost has consistently been agriculture (60-70%), which holds true in Scotland (53%) and Wales (71%) in 2014. There was limited data to evaluate English compost markets in 2014, except noting that 46% of English composting sites had PAS100 accreditation, indicating higher value markets were accessible for these sites.

In the UK in 2012, the landscaping market had the highest value (mean £10.51/t), followed by horticulture (£8.51/t), turf (£5.88/t), energy recovery (£2.92/t), agriculture (£0.75/t), and landfill restoration (£0.63/t). Insufficient responses to the recent survey mean that no data is available for England in 2014. However, the compost market is more mature than digestate and as such compost markets are not expected to have changed dramatically in England since 2012.

For the rest of Britain, according to Zero Waste Scotland and WRAP Cymru national surveys in 2014, the value of compost is greater in Scotland than in Wales, with values between £13-18/t being achieved in horticulture, turf and landscaping in Scotland, and £0-5/t in Wales, although not all sites disclosed their sale price. However, Scotland is supplying a diverse range of markets where composters are getting more for their compost output than in Wales where the predominant market is agriculture.

Access to higher value compost markets in the UK has grown, as Quality Compost Certification continues to rise. Over half of all permitted sites achieved PAS100 accreditation in 2014, increasing from 84 sites in 2008 (47% of total sites), to 180 sites in 2014 (51% of total sites). Uptake of the PAS100 scheme is markedly better in Scotland and Northern Ireland (100% uptake), compared to England and Wales (50% of sites), mostly due to recycling targets, development of end markets and product value recognition.

The composting industry has a growing workforce, with an estimated 1,434 jobs in 2014, compared to 1,184 in 2009.

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Compost Certification Scheme (CCS)
Biofertiliser Certification Scheme (BCS)
Organics Recycling Group (ORG)
Environmental Services Association (ESA)
Zero Waste Scotland (ZWS)
WRAP Cymru

Glossary

ADBA	Anaerobic Digestion and Bioresources Association
Anaerobic digestion (AD)	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.
BCS	Biofertiliser Certification Scheme
CCS	Compost Certification Scheme
Digestate	The residue resulting from the anaerobic digestion of biodegradable materials. Whole digestate may be separated into liquor and fibre fractions, referred to as liquid and solid digestate respectively.
EA	Environment Agency
Exempt waste operation	<p>A waste operation exempt from the need to hold an environmental permit where it meets certain criteria.</p> <p>Exemptions include:</p> <ul style="list-style-type: none">• 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 e.g. anaerobically digested manure and plant tissue waste in a dedicated AD plant to produce a digestate.
Farm-fed	Refers to installations where the contribution of agricultural feedstocks (e.g. manure; slurry; energy crops; crop wastes) towards the total feedstock requirement is greater than 50%.
FIT	Feed-in-Tariff scheme; support mechanism for renewable electricity generators (<5MWe capacity) in the UK.
LA	Local Authority
Mechanical biological treatment (MBT)	A generic term for an integration of several processes treating mixed wastes, such as Materials Recovery Facilities, sorting and composting or AD.
NNFCC	The Bioeconomy Consultants, formerly the National Non-Food Crops Centre.
ORG	The Organics Recycling Group; part of the REA which represents the membership of the former Association for Organics Recycling (AfOR).
Organic waste	Waste of animal or plant origin which, for recovery purposes, can be decomposed by micro-organisms, other larger soil-borne organisms or enzymes.

Parasitic load	Energy used in the anaerobic digestion process that does not contribute to the net electricity yield generated (non parasitic load).
PAS100	Publicly Available Specification 100, which is the British Standards Institution's specification for compost derived from source-segregated biodegradable materials, updated in 2011.
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 and revised in 2014.
Permitted waste operation	A waste operation 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.
REA	Renewable Energy Association
REAL	Renewable Energy Assurance Limited, a subsidiary of REA who deals with accreditation and certification schemes.
RHI	Renewable Heat Incentive; support mechanism for renewable heat producers in the UK.
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 1kt = 1,000 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 or 10 ³ M (mega) = 1,000,000 or 10 ⁶ G (giga) = 1,000,000,000 or 10 ⁹ T (tera) = 1,000,000,000,000 or 10 ¹²
Waste-fed	Refers to installations where the contribution of municipal (e.g. food waste; green waste), commercial (e.g. food waste) and industrial wastes (e.g. brewery waste; animal processing wastes) towards the total feedstock requirement is greater than 50%.
Watt-hour (Wh)	A measure of electrical energy equivalent to a power consumption of one watt for one hour – commonly abbreviated to Wh (kWh = kilowatt hour; MWh = megawatt hour; GWh = gigawatt hour; TWh = terawatt hour)

1. Introduction

The annual UK-wide organics recycling survey has been carried out since the mid-1990s and has provided invaluable data about the status of the biowaste treatment sector and a means of monitoring its development and expansion. It has been the only source of real capacity and throughput data for the organics recycling industry, helping to measure progress year on year.

As the organics recycling industry has developed and matured, its trade bodies have become experts in handling core information about the ambition, nature and capacity of the sector. Consequently, a number of different organisations now collect key data. This year is therefore a year of transition, in which the organics recycling status report is led by WRAP but delivered in partnership with industry bodies NNFCC, ADBA, REA, ORG and ESA. It is expected that future surveys and data collation will be led and completed by industry.

This report provides the tools and data sources to help industry to determine the status of the organics recycling industry in future years potentially without conducting a survey. Various public and commercial databases were used, which are described next to the corresponding results, and all sources are listed in a table in Appendix 1.

1.1 Scope of Project

This report provides a snapshot of the status of the UK's organics recycling industry in 2014. It covers compost and AD activities, but excludes MBT or sewage-based AD. It is a collation of data captured by WRAP, NNFCC, ADBA, REA, Defra, Environment Agency, Zero Waste Scotland and other public data sources. The study reports data where available covering England, Wales, Scotland and Northern Ireland. It is not a comprehensive survey as in previous years.

2. Methodology

The majority of data presented in this report has been collated from secondary data sources; from public and commercial databases, and 2014 organics recycling surveys led by Zero Waste Scotland (2014) and WRAP Cymru (2014/15).

For the AD sector, both farm and waste-based AD systems were included in the analysis. Waste water and AD plants integrated with MBT facilities were out of scope. Data presented for operational and planned activities came from combining and cross checking databases held by WRAP, NNFCC and ADBA to make sure that all plants recorded by each party were represented, to estimate the size of the sector more comprehensively. These AD databases were created using a range of sources, including planning applications, media reports and regular discussions with developers. Energy outputs were determined using national statistics held by DECC in the central FIT and RHI registers, Energy Trends, and the Digest of UK Energy Statistics (DUKES). To estimate market size of quality digestate, data from REAL's Biofertiliser Certification Scheme (PAS110) was used (under which only accredited digestate is represented).

For composting, data on inputs from local authorities were obtained from Waste Data Flow (extracted by WRAP), and permitted input from the Environment Agency's Waste Interrogator. For overall trends in local authority waste management, annual reports published by Defra (England), Scottish Environment Protection Agency (SEPA), Welsh Government and NI Environment Agency (see Appendix 1, Data sources: Local Authority Waste Management reports) were used. To estimate the size of quality compost markets, data from REAL's Quality Compost Certification Scheme (PAS100) were used.

Past surveys on the organics recycling industry carried out or commissioned by WRAP and other organisations were also used to compare values and monitor trends, particularly from 2008¹, 2009², 2010³, 2012⁴, 2013⁵.

In addition, a short survey was conducted to fill apparent gaps as opposed to being the primary means of data collection as has been the case in previous years. A survey was carried out for England and Wales via an online questionnaire, created on Survey Monkey and publicised by NNFCC, WRAP, ADBA, REA, ESA and REAL (Biofertiliser Certification Scheme and Compost Certification Scheme). The survey for England and Wales asked AD and compost operators to provide information about the management of organic feedstocks at their facilities, including type, source, tonnages, outputs, and markets. A full list of survey questions is included in Appendix 4.

Results from a separate survey carried out by Zero Waste Scotland (ZWS), were aggregated and presented in this report to represent Scotland. The full results from the Scottish organics recycling survey is available from the ZWS website⁶.

¹ *Market survey of the UK organics recycling industry - 2007/08, Association for Organics Recycling*

² *A study of the UK organics recycling industry in 2009, WRAP, 2011*

³ *A survey of the UK organics recycling industry in 2010, WRAP, 2012*

⁴ *A survey of the UK organics recycling industry in 2012, WRAP, 2013*

⁵ *A survey of the UK Anaerobic digestion industry in 2013, WRAP, 2014*

In addition WRAP Cymru have published a study on compost industry activity in 2014/15, including a comprehensive survey, analysis of Waste Data Flow, and PAS100 data⁷.

3. Results

This section outlines the results of the data analysis, collected from a range of public and commercial databases; some of the results from the short survey for England and Wales, and the specific surveys for Scotland and Wales undertaken independent of this project.

There is a lot of publicly available data, which has been used to capture a snapshot of AD and composting activities. These data were primarily provided by local authorities, planning applications, Government departments and agencies, certification schemes, and from project partners (see Appendix 1: Data sources).

AD databases held by WRAP, NNFCC and ADBA, and information from the Biofertiliser and Compost Certification Schemes were obtained through partnership and cooperation of all organisations and may be more difficult for anyone to centrally access in future years, particularly the aggregated data of all three databases generated here. In particular ADBA and NNFCC's AD databases are commercial, but they provide valuable collations of information on feedstocks, size, outputs, location, regional deployment, and future deployment required for analysis of the AD industry.

Despite good quality data being available for the compost sector from the WRAP Cymru and ZWS surveys, the short survey undertaken as part of this project was allocated significantly less resource and returned no additional data of statistical significance. However, sufficient data was obtained from publically available and commercial data sources to capture the remainder of industry activity, to enable trends and conclusions to be drawn.

3.1 Anaerobic Digestion

3.1.1 Size of the sector

3.1.1.1 Operational capacity

There were 259 operational AD plants in 2014 in the UK; 207 in England, 23 in Scotland, 19 in Northern Ireland, and 10 in Wales (Table 1). This provided a total operational throughput capacity of 6.57 million tonnes of organic materials⁸; 73.9% of which were wastes and residues as opposed to purpose grown crops. The highest proportion of waste feedstock was in Scotland (91.1%), followed by Wales (90.5%), England (71.6%), and Northern Ireland (62.9%). For a breakdown of feedstock types and volumes, see Chapter 3.1.2.

⁶ Zero Waste Scotland survey of the organics industry 2014

⁷ Survey of green waste compost production capacity in Wales in 2014/15, WRAP Cymru, 2016

⁸Includes AD sites treating industrial effluents from food manufacturing. Liquid waste adjusted, assumed 10% solids content hence only 10% of total volume reported

Table 1: Number and operational capacity of AD plants in 2014

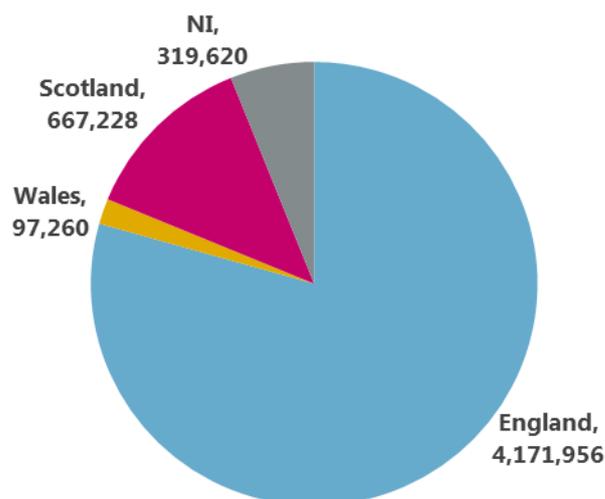
	Number of plants	Total organic feedstocks (tonnes)	Of which is waste (tonnes)	Waste
England	207	5,214,945	3,735,902	71.6%
Wales	10	121,575	110,075	90.5%
Scotland	23	834,035	760,035	91.1%
NI	19	399,525	251,325	62.9%
Total	259	6,570,080	4,857,337	73.9%

Data source: ADBA/NNFCC/WRAP AD databases (see methodology)

3.1.1.2 Actual throughput

In 2013, AD plants reportedly processed feedstock equivalent to 80% of their operational capacity according to WRAP's 2013 survey⁵. Using the same assumed processing capacity rate an estimated 5.26 million tonnes of feedstock were processed through AD in 2014; 3.89 million tonnes of which were wastes (including slurry/manure, crop wastes, food waste and other waste) (Figure 1).

Figure 1: Estimated actual throughput of AD facilities in 2014, in the UK (tonnes)



Data source: ADBA/NNFCC/WRAP AD databases (see methodology)

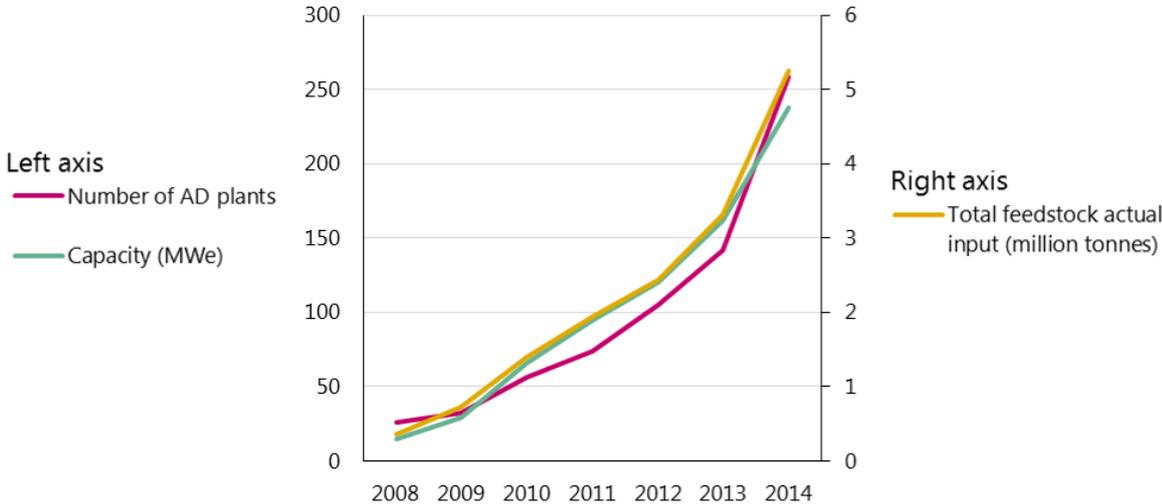
*AD operational feedstock throughput based on 80% of capacity

In the last ten years, there has been a sharp increase in the number of operational AD plants and the total volume of feedstock processed. Between 2013 and 2014 the industry has grown by 82% in terms of number of sites and 50% in terms of feedstock volumes (Figure 2), however, the change of methodology in 2014 is likely to be the cause here.

The use of commercial databases in 2014 as opposed to grossed figures from survey data previously has resulted in a greater number of deployments being captured from a range of sources including planning applications, media releases and stakeholder interaction (Figure 2). In addition, previous to this change the methodology varied

between survey years, for example changing from surveying waste only operators in 2009, to more proportional surveying of waste and farm based AD combined with grossing up in 2013. Nevertheless, this and related market reports show a clear trend that the AD sector has grown significantly both in terms of operational capacity and actual throughput.

Figure 2: Number of AD sites and feedstock input in the UK (2008-2014)



Data sources: ADBA NNFCC/WRAP/ combined database (see methodology)
 *Actual input was assumed to be 80% of planned feedstock inputs, as per WRAP 2013 AD survey average.

3.1.1.3 Permitted AD facilities

According to the public list of permitted sites, a total of 48 AD facilities were permitted by the Environment Agency to operate as regulated waste management facilities in England in 2014, reporting a combined input of 335,028 tonnes of waste (Table 2). This value represents only 9% of AD waste treatment capacity in England in 2014 (Table 1) or just 11% of actual throughput (Figure 1). This figure is low for several reasons, including: a mis-reporting of site-type by some facilities where more than one activity may occur on the same site; time-lag in releasing data into the public domain; sites operating under an exemption for a short period when they first become operational; and difficulties interpreting data extracted from the complex Waste Data Interrogator. Furthermore, some wastes do not require a permit, such as agricultural residues, manure/slurry, and small volumes of low risk food industry by-products, and commercial food waste (see 3.1.2 Feedstock).

The Zero Waste Scotland 2014 survey⁹ captured seven facilities permitted to accept regulated wastes handling 410,667 tonnes (Table 2). This represents 54% of wastes going into AD in Scotland. It was not possible to locate values for permitted capacity in Wales or Northern Ireland from any of the available sources due to different reporting regimes.

⁹ Note permitted capacity was not part of the Zero Waste Scotland survey, so results just show merchant sites.

Table 2: Permitted AD facilities receiving waste, England and Scotland¹⁰, 2014

AD	Total input (permitted sites, tonnes)	No. plants permitted to receive waste
England	335,028	48
Scotland	410,667	7

Data source: EA Waste Interrogator and ZWS survey results⁶

3.1.2 Feedstock

The following definitions are used for data segregation in this section:

'Waste-fed' refers to installations where the contribution of municipal (e.g. food waste; green waste), commercial (e.g. food waste) and industrial wastes (e.g. brewery waste; animal processing wastes) towards the total feedstock requirement is greater than 50%.

'Farm-fed' refers to installations where the contribution of agricultural feedstocks (e.g. manure; slurry; energy crops; crop wastes) towards the total feedstock requirement is greater than 50%.

3.1.2.1 Feedstock sources

Of the 259 operational AD plants in the UK, 162 were defined as farm-fed and 97 waste-fed in 2014. Total installed capacity was 6.57 million tonnes (2.73 million tonnes of capacity in farm-fed plants and 3.84 million tonnes in waste-fed plants), and an estimated 5.25 million tonnes of material was processed. In the UK, the largest volume of feedstock was post-consumer food waste (35%), followed by crops (26%), other waste (including industrial processing wastes) (21%), manure/slurry (14%), and then crop waste (4%).

AD plants in England had a similar feedstock profile to the UK total, representing the majority of the sector (Figure 3). However, Scotland had a much higher proportion of 'other wastes' (64% of total) which is largely waste from distilleries, and much lower crop inputs. Wales also had more 'other wastes' and lower crop inputs than England, but a higher proportion of manure than Scotland or England. Northern Ireland was different to the rest of the UK, with crops (37%) and manures (30%) being the predominant feedstocks. Crop use differed between nations, with higher crop use in Northern Ireland (37%) and England (29%), than Scotland and Wales (both 9%).

¹⁰ It was not possible to locate values for permitted capacity in Wales or Northern Ireland from any of the available sources due to different reporting regimes.

Figure 3. Total capacity and estimated actual throughput of feedstocks in AD facilities in the UK in 2014



Data source: ADBA/NNFCC/WRAP AD database for raw data, and for actual input estimate coefficient: WRAPs 2013 AD survey average of AD actual throughput (80% of capacity)⁵

In England and Wales, data for local authority waste was extracted from Defra’s Waste Data Flow for the period April 2013 to April 2014¹¹. 191,830 tonnes and 52,686 tonnes of local authority wastes were sent to AD facilities for treatment in England and Wales¹² respectively in this period (Table 3). This means 54% of all regulated wastes reported (355,028 tonnes) were sourced from local authorities in England. The remainder of regulated feedstocks may be from commercial or industrial sources, or redirected from

¹¹ Data reporting spans calendar years and data for 2014-2015 was unavailable at the time of writing the report, hence the different data range quoted.

¹² Figures not available for Wales and Scotland from the available data sources

incinerators and landfill which may not be included in local authority figures. It is also worth noting, tonnages are reported at the gate of the re-processor and include materials which may subsequently be rejected, but do not include organic tonnages which arrive at the re-processor having already been treated or diverted via another process.

Table 3: Waste sent to AD facilities from local authorities in England and Wales, in tonnes (April 2013 - March 2014 inclusive)

AD	Tonnes
England	191,830
Wales	52,686
Scotland	70,000
Total	314,516

Data source: England and Wales data from Waste Data Flow 2013-2014, Scotland grossed data from Zero Waste Scotland Organics recycling industry survey 2014.

AD plants also receive redirected materials from a variety of permitted waste activities further adding to complexities reporting and accessing data. This included material diverted from treatment centres (136,950 tonnes), incinerators (66,008 tonnes), landfill (1,116 tonnes), and materials recovery facilities (28,120 tonnes) in England in 2014¹³.

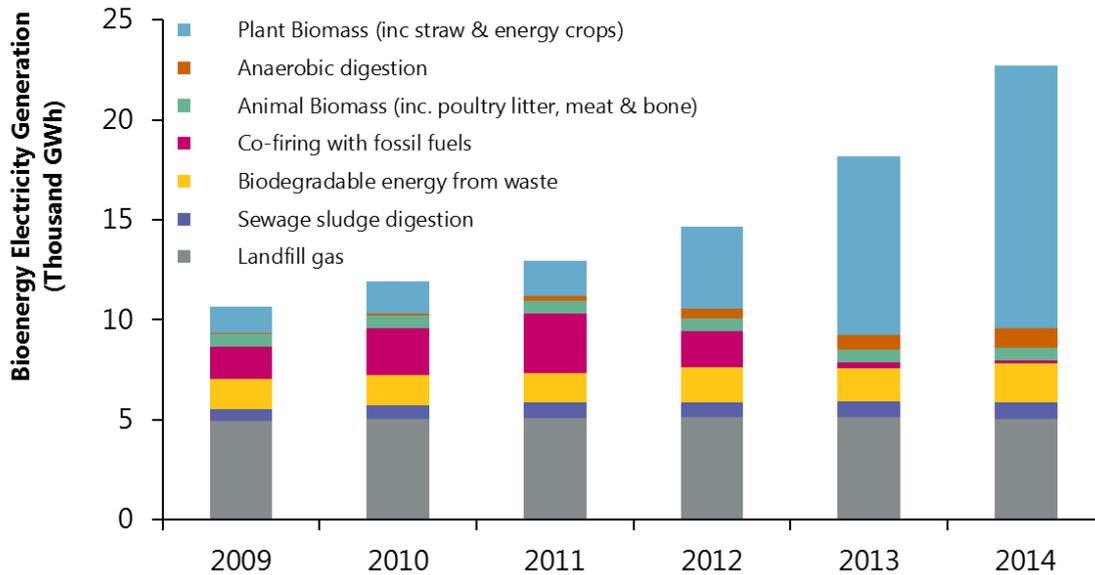
3.1.3 Outputs

3.1.3.1 Electricity output

In 2014, bioenergy (including AD and biomass combustion) generated 22,700 GWh of electricity, which constituted 35% of all renewable electricity and 6.63% of total electricity generated in the UK. Of this, AD made up 4.4% of the UK’s total bioenergy generation (Figure 4). The rapid expansion of the AD sector in recent years has led to an increased generation of electricity for distribution via the national power grid from 16 GWh in 2008 to 1,009 GWh in 2014 (Figure 5), and is still growing markedly (DUKES, 2015). This excludes sewage sludge AD, animal biomass and energy from waste (some of which is processed using anaerobic digestion), and landfill gas, which are noteworthy but not included in the project scope to analyse further.

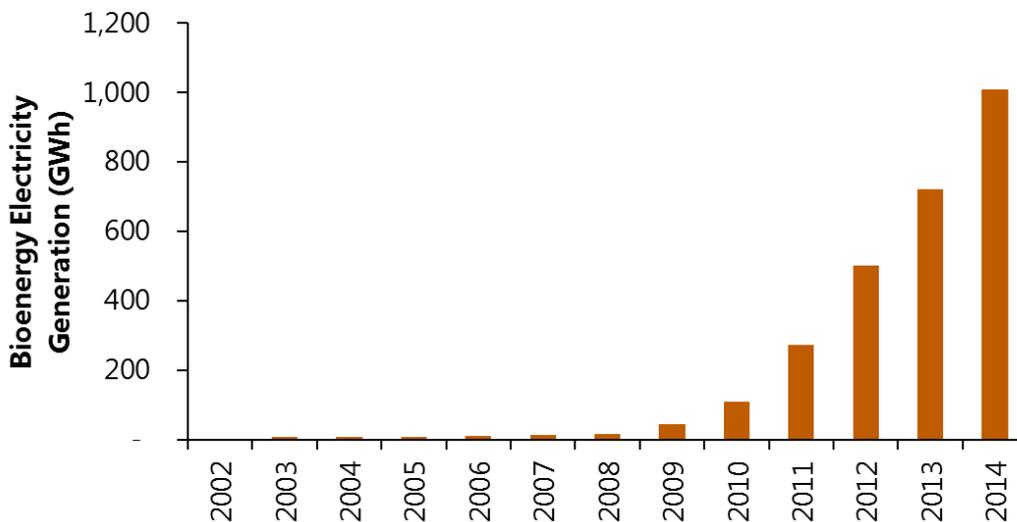
¹³ Environment Agency Waste Interrogator

Figure 4: Electricity generated from bioenergy facilities in the UK



Data source: Digest of UK Energy Statistics, 2015, DECC

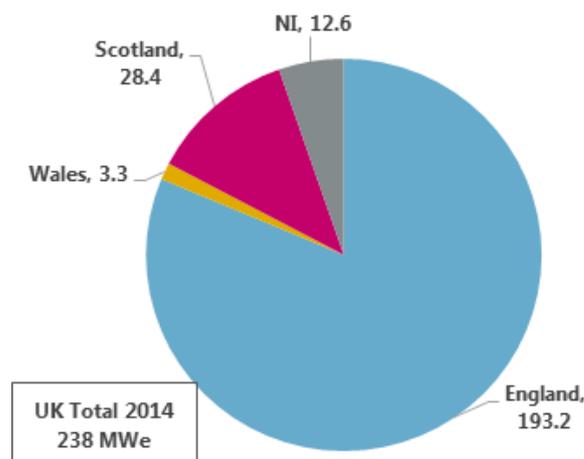
Figure 5: Electricity generation exported to the grid from AD facilities in the UK



Data source: Digest of UK Energy Statistics, 2015, DECC

Similarly, the total installed electrical capacity from AD facilities has increased steadily to 238 MWe in 2014; the majority of which is in England (193 MWe), followed by Scotland (28 MWe), Northern Ireland (13 MWe) and Wales (3 MWe) (Figure 6).

Figure 6. Installed capacity of electricity generation from AD facilities in the UK in 2014 (MWe)



Data source: ADBA/NNFCC/WRAP AD databases

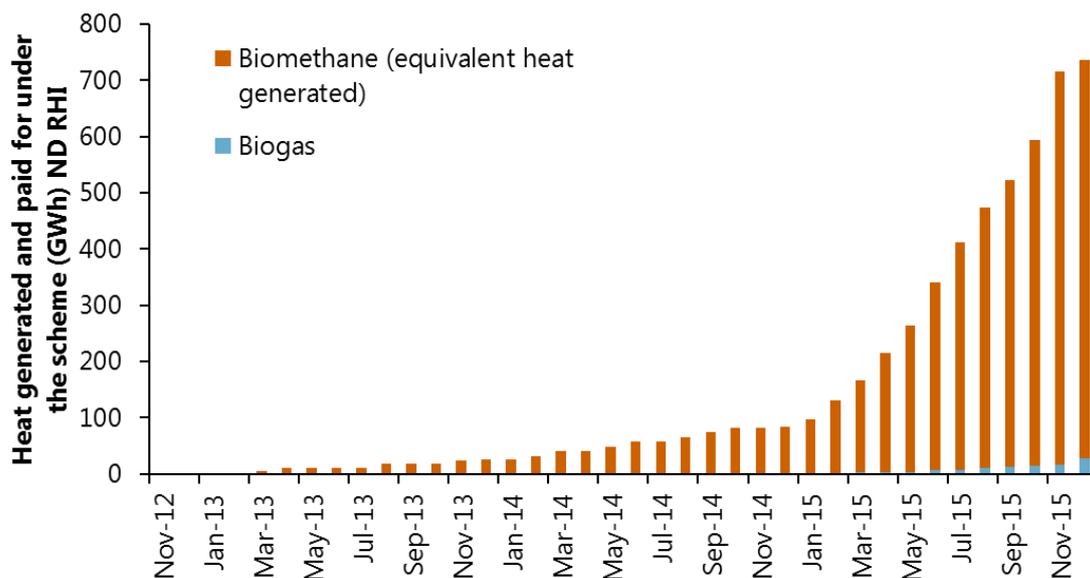
3.1.3.2 Heat and biomethane output

Biomethane from AD (i.e. biogas upgraded to biomethane by removal of CO₂ and other contaminant gases) is mostly exported to the gas grid for heating homes and commercial premises; whereas biogas CHP plants generate heat and power by combustion of biogas.

The renewable heat market is growing rapidly, with 2,045 GWh generated and paid for in the UK under the non-domestic Renewable Heat Incentive (RHI) scheme by December 2014 (and 5,321 GWh by Nov 2015). Bioenergy produced 99% of renewable heat under the non-domestic RHI scheme in 2014, mainly from biomass boilers (95%). Most heat produced by AD will be represented here, as the use of heat from biogas combustion for non-parasitic purposes and biomethane injection is driven by the RHI. Heat generated by biogas combustion and claimed under the RHI is reportedly used for space and process heating, digestate drying, feedstock preparation and pasteurisation.

Biomethane produced the equivalent of 83 GWh of heat by December 2014, which equates to 4% of the non-domestic RHI, whereas only 1 GWh of biogas heat was registered, representing 0.05% of the non-domestic RHI. However, biomethane production has been expanding rapidly in the last few years, from 0 GWh in December 2012, to 83 GWh in December 2014, and 689 GWh in 2015 (13% of non-domestic RHI). Meanwhile, there has been a more modest increase in renewable heat from biogas combustion, from 0 GWh in December 2013, to 1 GWh in December 2014, and 28 GWh in November 2015 (Figure 7).

Figure 7: Heat generated and paid for from AD under the non-domestic RHI scheme (to November 2015)



Data source: DECC RHI Deployment Statistics

The number of AD plants receiving RHI for biogas combustion has increased (4 in 2014, 27 in 2015). Similarly, growth has been experienced in biomethane with 25 plants accredited in the UK in 2014; 23 in England and 2 in Scotland (see Table 4 for capacity). Currently there is no biomethane production in Wales or Northern Ireland. All but one biomethane plant also has a CHP and are therefore also reported in the number of plants producing electricity.

Table 4: Biomethane capacity from operational AD plants in 2014

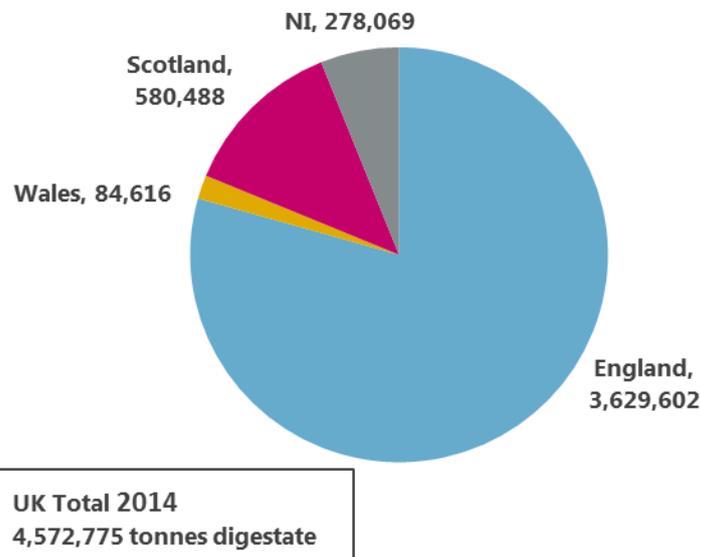
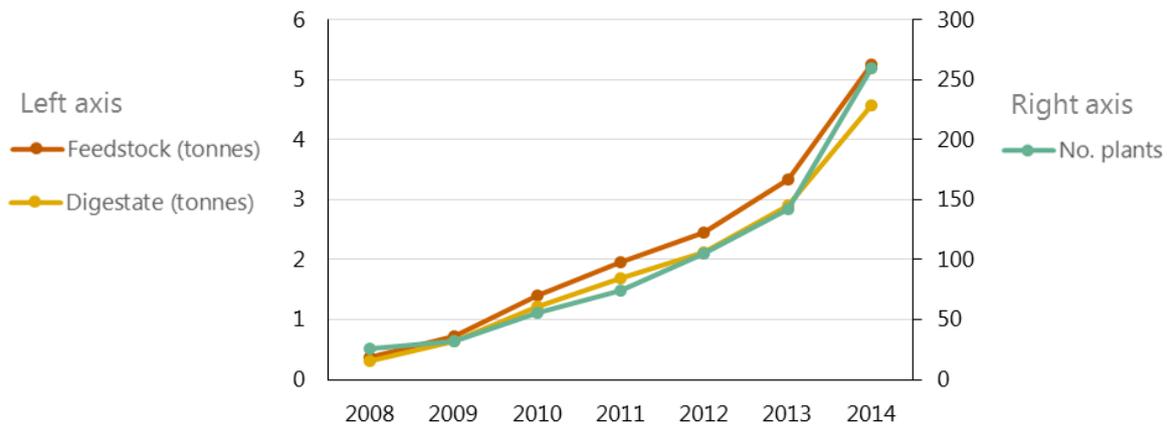
	Biomethane capacity (Nm ³ biogas/hr)	Number of plants
England	13,746	23
Wales	0	0
Scotland	3,355	2
NI	0	0
Total	17,101	25

Data source: NNFCC AD database

3.1.3.3 Digestate output

The amount of digestate produced in 2014 was estimated to be 4.57 million tonnes¹⁴ (Figure 8). The feedstock: digestate production coefficient used (0.87) was taken from a survey of the UK AD industry in 2013 (WRAP)⁵, as the average output of digestate was 87% of the input volume in facilities surveyed that year. Although this proportion may vary depending on feedstock and technology configuration, the average is expected to be relatively stable.

Figure 8. Whole digestate production in the UK between 2008 and 2014, and digestate produced in the UK regions in 2014 (tonnes).



Data source: ADBA/NNFCC/WRAP AD databases

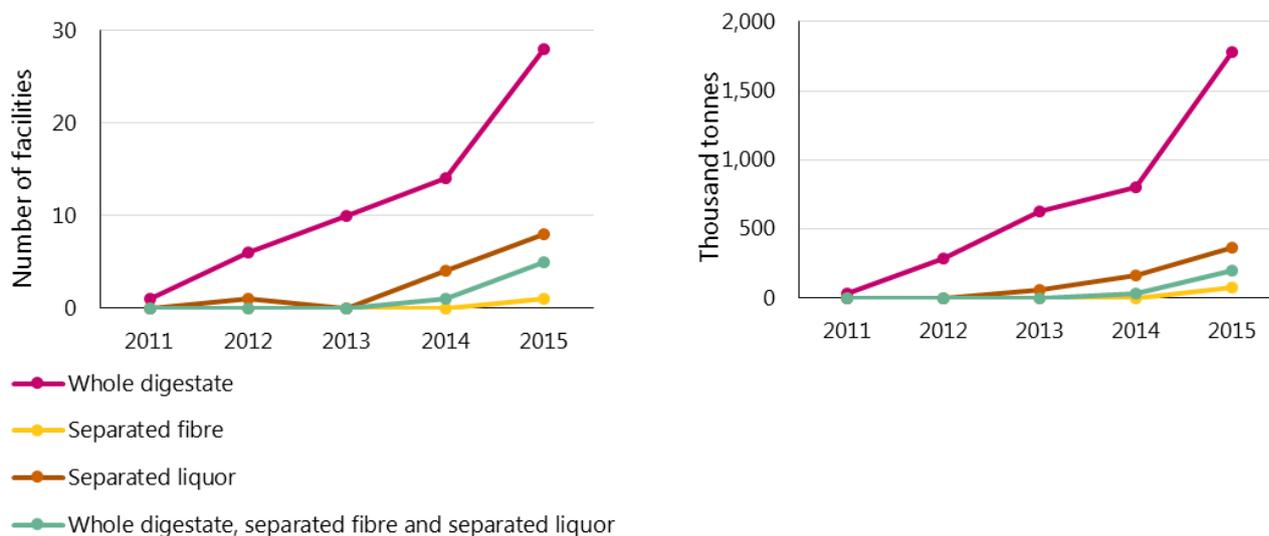
¹⁴ Includes sites treating industrial effluents from food manufacturing. Liquid waste adjusted, assumed 10% solids content hence only 10% of total volume reported as throughput and digestate output adjusted accordingly.

3.1.3.3.1 PAS110 accredited digestate

The Biofertiliser Certification Scheme (BCS) accredits quality digestate with a PAS110 certificate. It facilitates the market for digestate by providing assurance to customers that digestate produced from AD is safe to use without risk to human, animal and plant health and can be used as a fertiliser without the need for waste permitting.

In the UK in 2014, almost 1 million tonnes of digestate was PAS110 accredited from 19 AD facilities (7.3% of sites), and in 2015 this figure more than doubled with over 2.4 million tonnes of PAS110 digestate being accredited from 42 AD facilities (Figure 9). Most certified digestate is in the form of whole digestate (80.4% in 2014 and 73.5% in 2015), but the remainder is reported as separate fractions of fibre (0% in 2014 and 3.1% in 2015 - from one site in NI) and liquor (16.6% in 2014, 15.2% in 2015), or multiple separated products including whole digestate and separated liquor and fibre (3.0% in 2014, 8.2% in 2015).

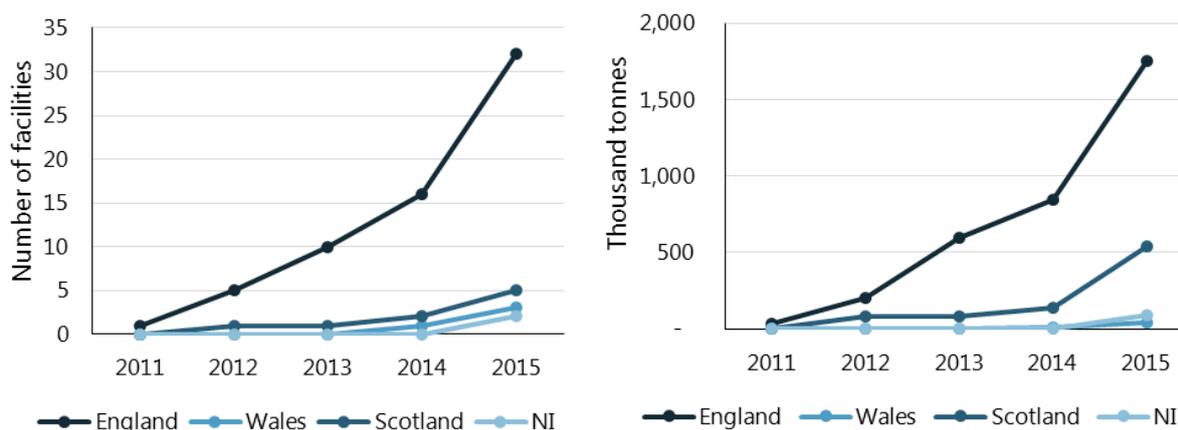
Figure 9. PAS110 certified facilities and digestate in the UK, by product type



Data source: Biofertiliser Certification Scheme, REAL

In England 847,000 tonnes of digestate was accredited from 16 facilities, followed by Scotland with 140,000 tonnes from two facilities, and Wales with 11,500 tonnes from one facility. No digestate was accredited in Northern Ireland. However, the nation with the highest proportion of PAS110 accredited sites in 2014 was Wales (10.0%), followed by Scotland (8.7%), England (7.7%), and Northern Ireland (0.0%). There was a significant increase in accreditation for all countries in 2015 (Figure 10). The recent increase is likely due to policy changes that require digestate to be PAS accredited to count as recycling, which is important for local authority targets.

Figure 10: PAS110 certified digestate, by nation (tonnes) time series



Data source: Biofertiliser Certification Scheme, REAL

3.1.4 Employees

In 2014, the number of jobs in AD operations in the UK was estimated to be just over 1,000 full time equivalent (FTE) with 819 in England, 14 in Wales, 121 in Scotland and 54 in Northern Ireland (Figure 11). Coefficients were used for estimating jobs in AD, developed through a combination of surveys, media reports, and models¹⁵. Coefficients include jobs in operation and construction, with the latter being spread over several years – peaks in employment as a result heightened construction activity are therefore not illustrated using this method.

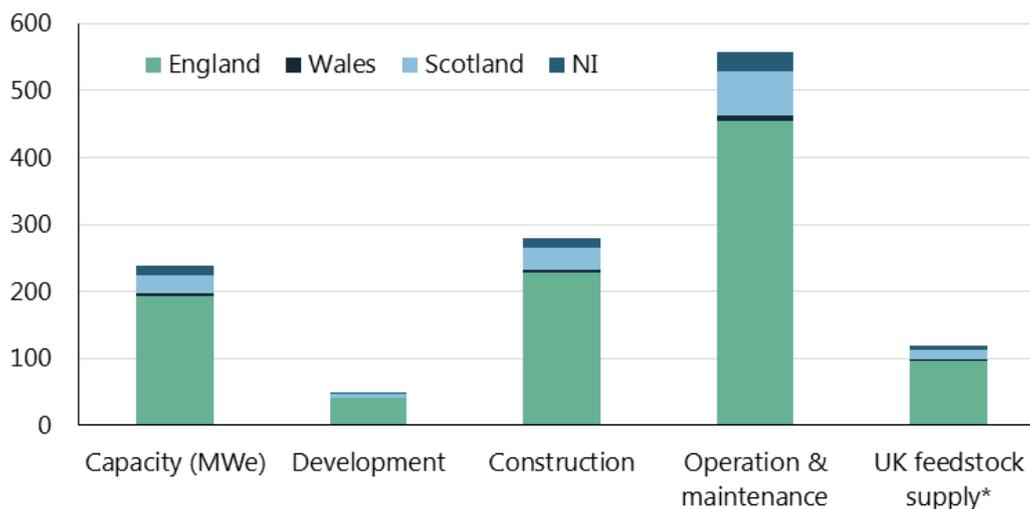
According to this methodology, there has been a 46% increase in the numbers of jobs coinciding with the increase in deployment, growing from an estimated 688 jobs in 2013 to 1,008 in 2014. This could more than double by 2019 to 2,776 jobs if all planned projects (see 3.1.5) follow through to completion¹⁶, which realistically depends on the future development landscape (Figure 12).

¹⁵ UK jobs in the bioenergy sectors by 2020, NNFCC, 2012.

https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/48341/5131-uk-jobs-in-the-bioenergy-sectors-by-2020.pdf Employment coefficients: Plant design/development 0.21 FTE/MWe, Construction and commissioning 1.18 FTE/MWe, Operation & maintenance 2.35 FTE/MWe, UK Feedstock supply 0.5 FTE/MWe.

¹⁶ Typically apply a 50% attrition rate to the project development pipeline, in light of planning, finance and feedstock issues causing plants to stall or withdraw altogether.

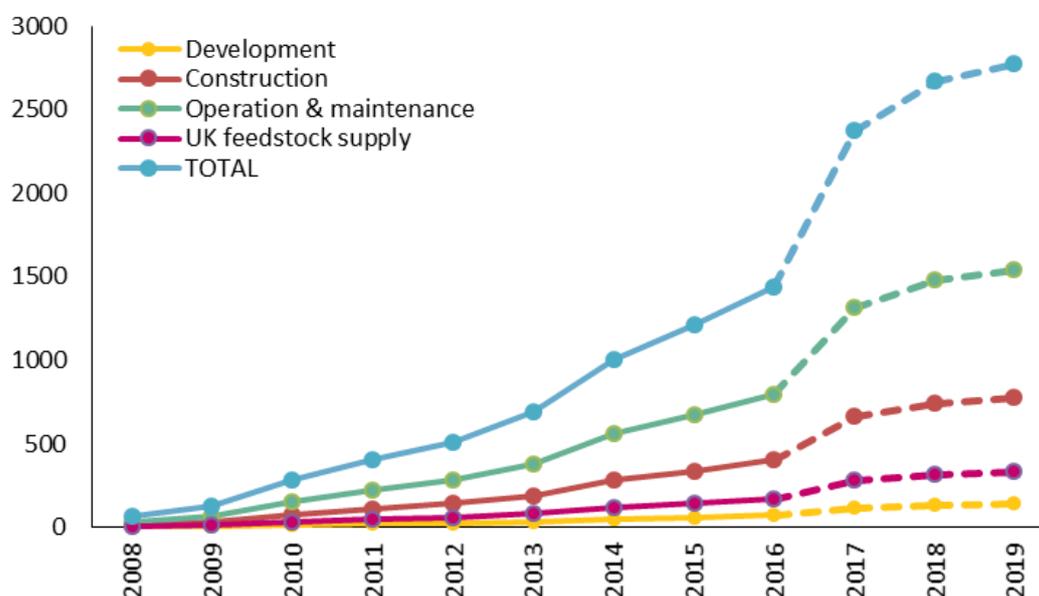
Figure 11. Employment numbers in the AD industry in 2014, by UK region



*Feedstock supply includes personnel employed in waste management, farming and logistics to handle AD feedstock specifically

Data source: ADBA /NNFCC/WRAP AD database 2014, and NNFCC bioenergy employment coefficient

Figure 12. Theoretical potential of employment numbers in the AD sector 2008-2019 in the UK, assuming 100% of plants in the development pipeline successfully complete



Data source: NNFCC/WRAP/ADBA AD databases and NNFCC bioenergy employment coefficient. Note the coefficient for construction is spread over several years, and in reality the construction period is 1-2 years; therefore the chart does not show peaks and troughs of construction employment, and is instead averaged out over time.

3.1.5 Planned capacity

There were 511 plants in the development pipeline (planned, planning application submitted or approved, or under construction) additional to those operational in 2014. If all AD plants complete successfully there would be over 750 AD plants in the UK by 2019 (Figure 13) with installed capacity greater than 650 MWe (Figure 14); and a total of 95 biomethane plants producing 55,834 NM³/hr¹⁷ (Figure 15).

Figure 13: Operational AD plants up to April 2016, and planned deployment to 2019

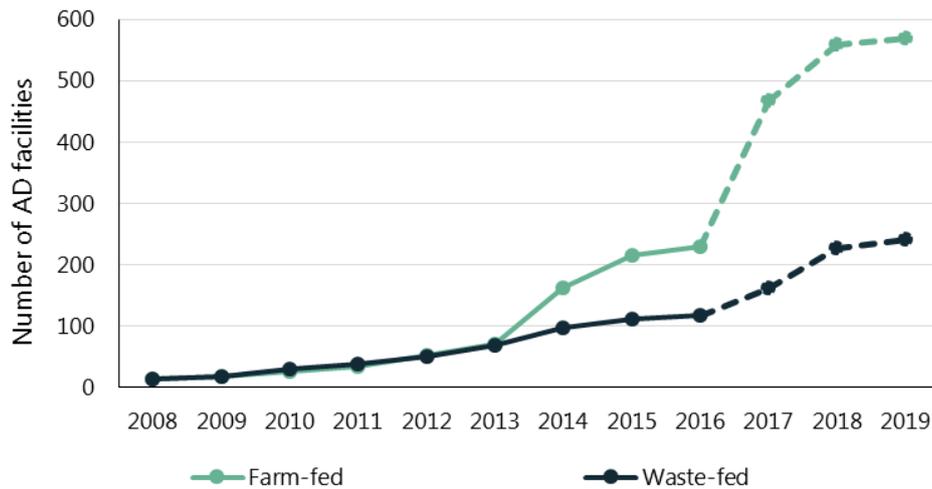
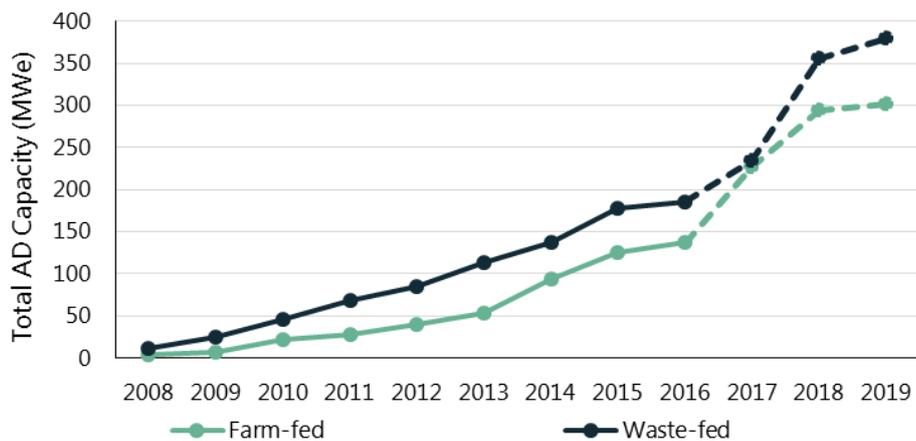
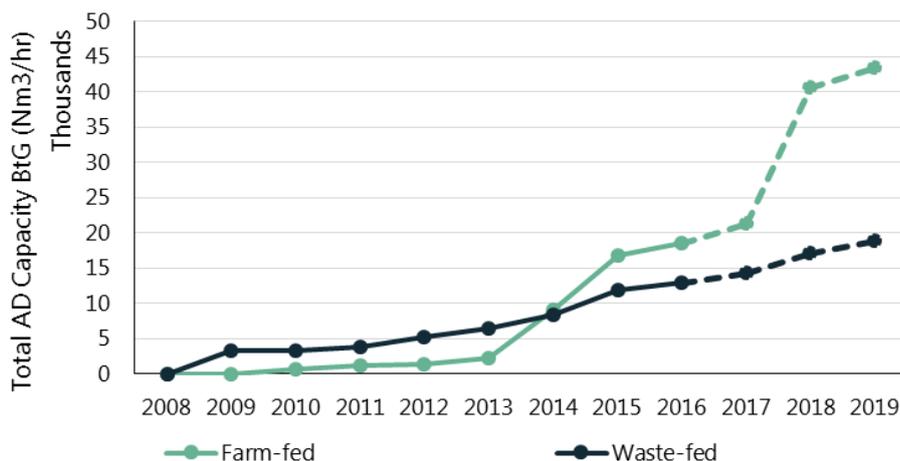


Figure 14: Installed electrical capacity up to April 2016, and planned capacity to 2019



¹⁷ As announced by developers in the media or in planning applications and collated in NNFFCC's AD database

Figure 15: Installed biomethane to grid (BtG) capacity up to April 2016, and planned capacity to 2019

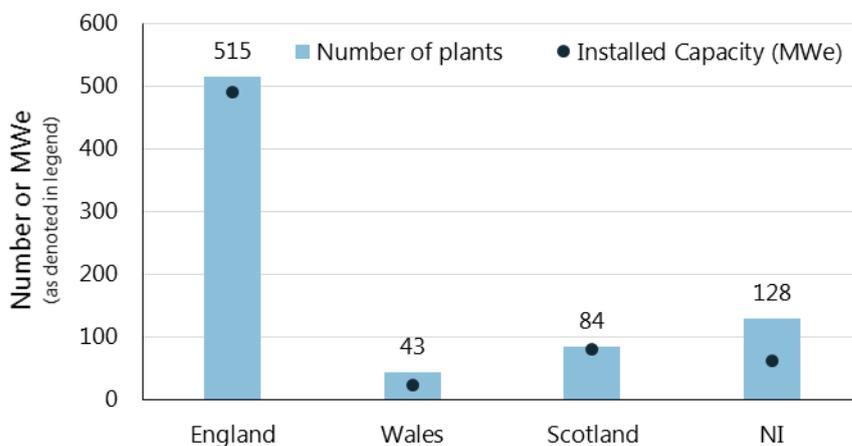


Data source: NNFCC AD deployment database, April 2016.

*Note future growth is theoretical, based on facilities in planning and is likely to be ~50% lower in reality.

Breaking the pipeline of planned facilities down by nation, a potential 515 plants could be built in England by 2019 (490 MWe capacity), 43 plants in Wales (22 MWe capacity), 84 plants in Scotland (79 MWe capacity), and 128 plants in Northern Ireland (62 MWe capacity) (Figure 16). However, this is only the theoretical potential if all planned plants successfully complete, which depends on policy, incentives and feedstock availability.

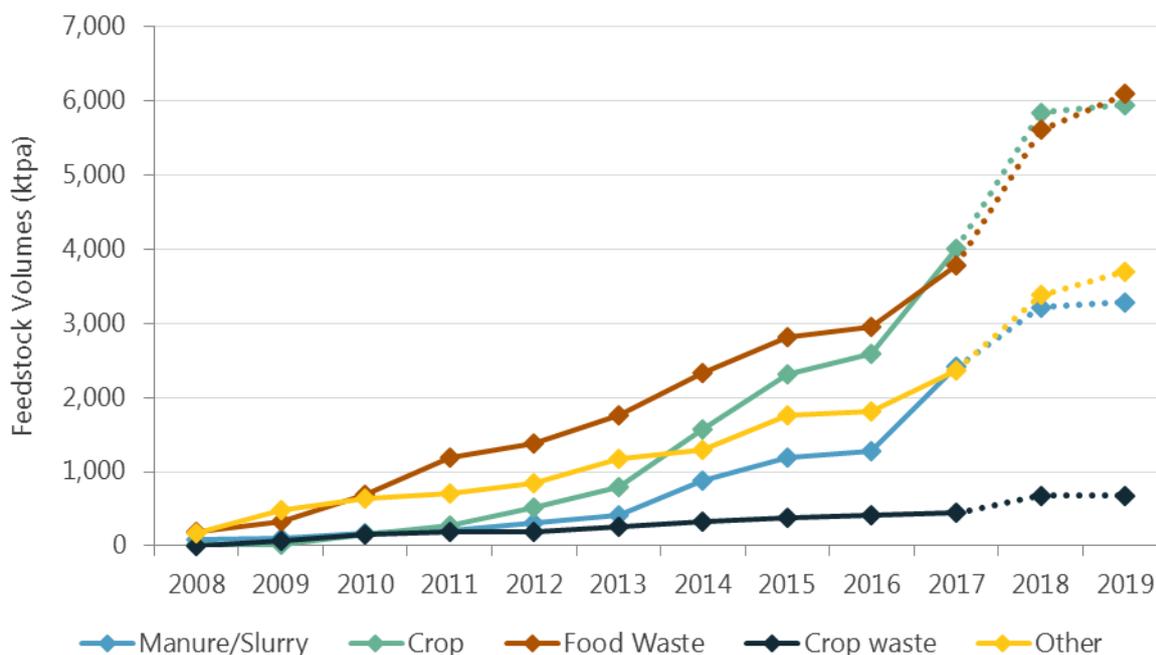
Figure 16: Potential number of AD plants by 2019 in the UK regions, if 100% of planned facilities complete



Data source: NNFCC AD deployment database, April 2016. Data labels represent number of plants

Based on a 100% completion rate of AD projects planned, a total of 15.04 million tonnes of feedstock (actual throughput) would be required in 2019 (Figure 17).

Figure 17: Time series of annual feedstocks requirements up to April 2016 (solid line) and planned feedstock capacity for AD plants to 2019 (dotted line)



Data source: NNFCC AD deployment database, April 2016.

However, to temper the above projections based on historic data and recent trends¹⁸, it is expected that only 50% of planned plants will proceed to construction and complete as scheduled. Therefore it is more likely there will be a total of just over 500 AD plants by 2019, which would require 10 million tonnes per year of organic materials, producing almost 9 million tonnes of digestate¹⁹. These plants would have a total capacity of around 450 MWe and over 35,000 NM³/hr (biomethane).

3.2 Compost

The following section describes the status of the composting industry in 2014. Only permitted sites were represented in this data, as it is publicly accessible from the EA²⁰, SEPA and NIEA (permitted sites are required to report throughput of materials on an annual basis) and this captures all sites managing permitted waste streams, representing a significant proportion of the industry. In the absence of a comprehensive survey, this report was unable to capture data from smaller composting sites that are exempt who have no obligation to formally report their activities.

3.2.1 Permitted site capacity

There were an estimated 362 composting sites active in the UK in 2014 (Table 5). Response rates for the 2014 surveys were good; 27 out of 29 active sites responded in

¹⁸ Anaerobic Digestion deployment in the UK, NNFCC, 2016

¹⁹ Estimated based on NNFCC's December 2016 AD database

²⁰ Includes England and Wales

Scotland²¹ and in Wales all 17 sites responded (for 2014/15)²². The number of composting sites reporting to the EA in England was 330 in 2015²³, and 271 in 2012²⁴, therefore in 2014 there was an estimated 310 permitted composting facilities active in England, (based on the mid-point between 2013 and 2015).

Table 5: Number of permitted composting sites, by region

Year	England	NI	Scotland	Wales	Total
2009	217	5	44	15	281
2012	271	6	30	16	323
2014	310	6	29	17	362

Data source: 2009/12 - previous WRAP organic surveys²⁴; 2014 - for England: estimate based on mid-point between EA 2013 and 2015 data, Scotland: ZWS Scotland Organics survey 2014⁶ and Wales: Wales Cymru Compost Survey 2014/15⁷. Estimate combining reported/surveyed/previous years.

3.2.2 Actual throughput

An estimated 5.92 million tonnes of organic material went to composting in the UK in 2014 (Figure 18) based on the following methodology. For England, throughput was taken from the EA's figure representing total permitted composting activity (5.13 million tonnes)²⁵. This is likely to be an underestimate, as the EA Waste Interrogator has only published data for 261 sites in England, out of an estimated 310 in 2014. This represents a current gap in publically available data, which is difficult to fill without complete reporting of information from these additional permitted sites and in the absence of a comprehensive survey.

Survey data was used for Wales⁹ and Scotland⁸. For NI, 190,000 tonnes of input was estimated from local authority waste figures²⁶ as there is no other readily available data. These methods of estimation may not be precise, and are most likely to be an underestimate; however, the resultant figure is in line with previous year's estimates, and makes best use of the publicly available data.

²¹ Zero Waste Scotland survey of the organics industry, 2014

²² Survey of green waste compost production capacity in Wales in 2014, WRAP Cymru, 2016

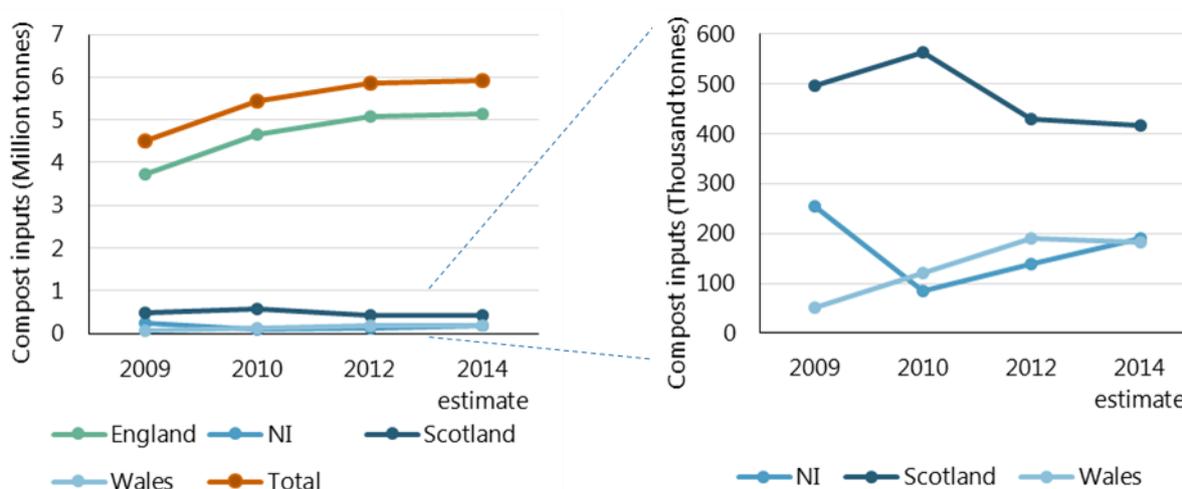
²³ Contact at the Environment Agency

²⁴ A survey of the UK organics recycling industry in 2012, WRAP

²⁵ EA Waste Interrogator

²⁶ Using the amount of LA waste sent to composting (156,875 tonnes in 2013/2014) from 'Northern Ireland local authority collected municipal waste management statistics: Annual Report 2013/14', and assuming compost consisted of the UK average (82%) proportion of LA material in total compost from the last 5 WRAP organics surveys 2007, 2008, 2009, 2010, 2012.

Figure 18: Estimated total inputs going to compost in the UK, 2014
 (Right-hand chart is an expansion of the cluster of data points in the left-hand chart)

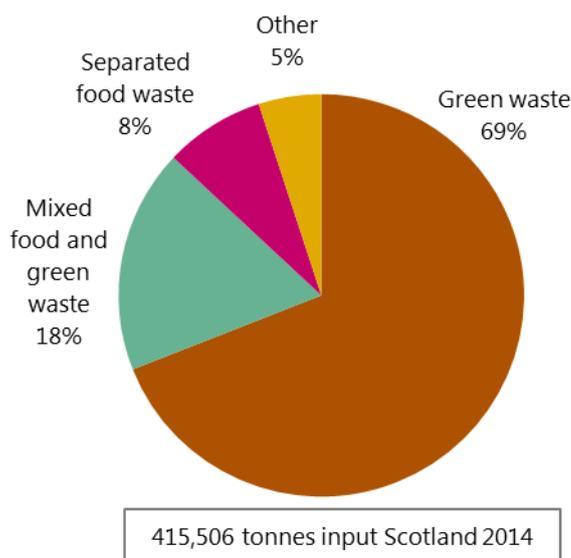


Data source: For 2009, 2010, and 2012 previous WRAP organic surveys. For 2014: England: EA Waste Interrogator, NI: assuming LA 'waste sent to organics' is 82 % of compost inputs, Scotland: ZWS organics industry survey 2014, Wales: WRAP Cymru Compost survey 2014/15.

3.2.3 Feedstock

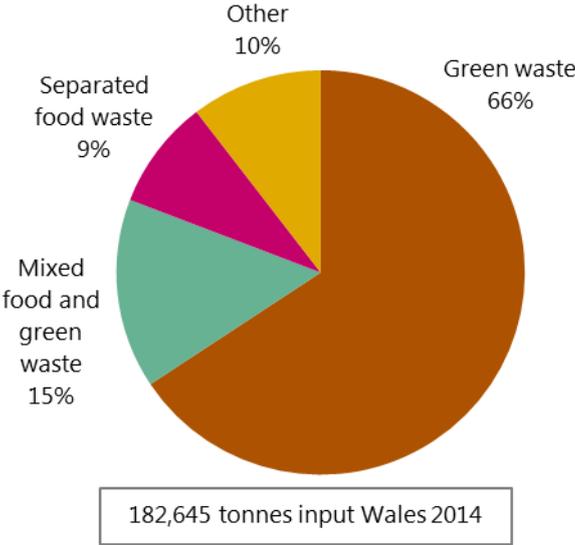
In 2014 the largest proportion of material into composting was from green waste (67.3%), similar to previous years (~65%) (Figure 19 and 20). There was an apparent increase in the proportion of separated food waste in Scotland and Wales; this included food waste from food manufacturers, hospitality and supermarkets, as well as local authorities.

Figure 19: Compost feedstock, by type in Scotland (2014)



Data source: ZWS organics industry survey 2014. 'Other' includes agricultural residues, sewage sludge, wood, liquids, manure and from other composting sites.

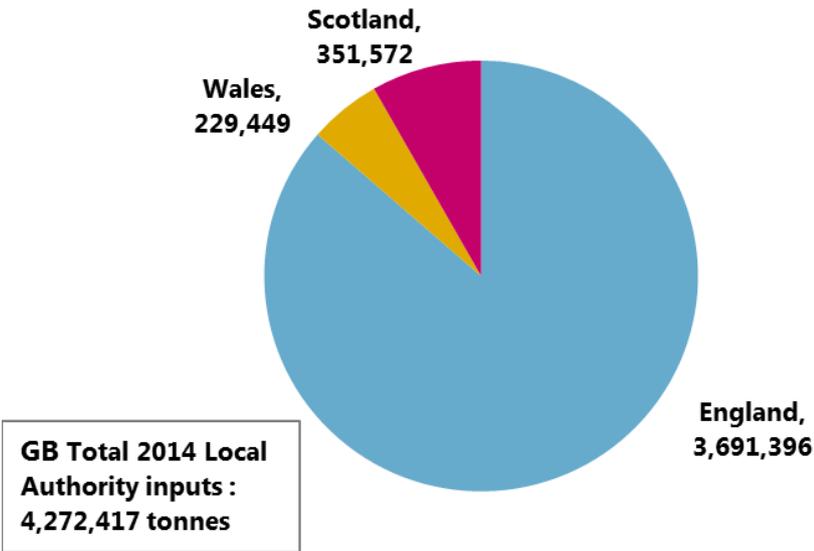
Figure 20: Compost feedstock, by type in Wales (2014/15)



Data source: Survey of green waste compost production capacity in Wales in 2014/15, WRAP Cymru, 2016. 'Other' includes agricultural residues, sewage sludge, wood, liquids, manure and material diverted from other composting sites.

The amount of compost input from local authorities was reported in Waste Data Flow (extracted by WRAP) as 3,691,396 tonnes in England and 229,449 tonnes in Wales in the period from April 2013 to April 2014 (Figure 21). In Scotland 351,572 tonnes of local authority waste was reported to go into composting, as reported by ZWS survey respondents. Tonnages were those reported at the gate of the re-processor and include material which may subsequently be rejected, but do not include organic tonnages which arrive at the re-processor having already been treated or diverted via another process.

Figure 21: Total organic material reported to be sent to composting facilities from Local Authorities, April 2013 to March 2014 (tonnes)



Data source: Waste Data Flow for England and Wales extracted by WRAP, Scottish data from Zero Waste Scotland survey results.

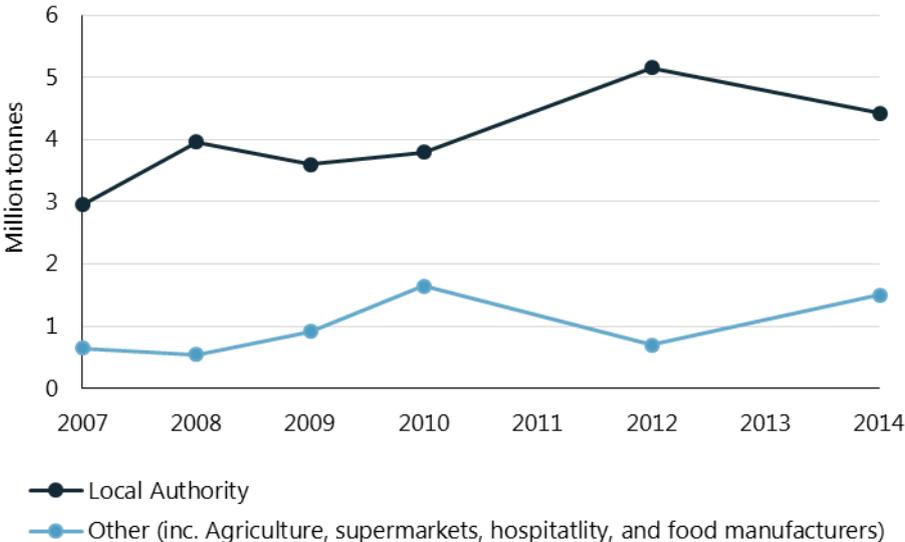
In Scotland other sources of inputs, included materials from landscapers (5%), food manufacturers (4%), agriculture (3%), hospitality (2%), and supermarkets (1%). In Wales, feedstocks were also sourced from commercial green waste, including chipboard manufacturing, arborists, gardeners and landscapers, and commercial food waste. There is limited data for England and Northern Ireland on other sources of inputs.

There has been an increase in inputs each year since 2007; from 3.6 million tonnes in 2007¹, to 5.85 million tonnes in 2012⁴, and 5.92 million tonnes (estimated) in 2014 (Figure 22). Estimates for local authority sources of feedstock were made using Waste Data Flow for England, Wales, and NI, and survey data for Scotland⁶.

Between 2007 and 2012 the amount of food and green wastes from local authorities increased, however in 2014 local authorities reported lower volumes sent to compost than in 2012²⁷. Comparing the 2014 data with previous years may be misleading due to differences in methodology, as Waste Data Flow may not capture all inputs from local authorities (such as those diverted from other treatment facilities), and past surveys may have overestimated local authority inputs (see Appendix 2 for full analysis of local authority waste).

²⁷ Waste Flow Data

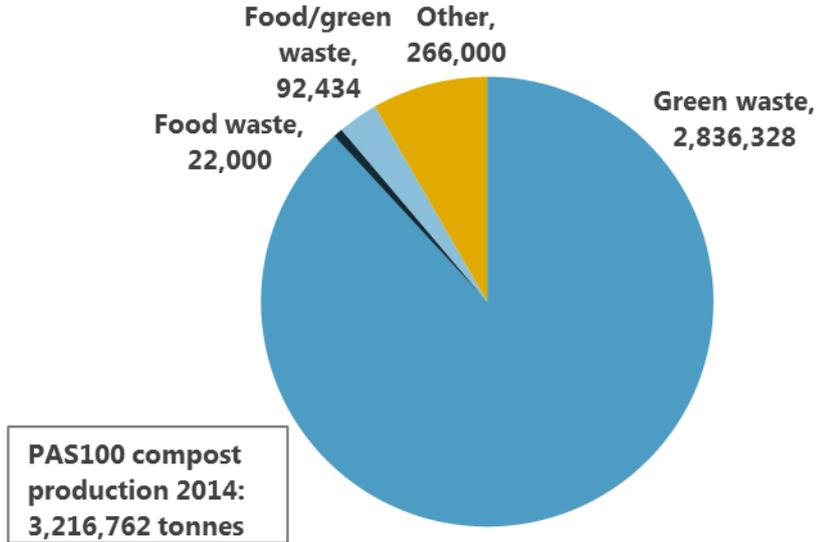
Figure 22: Estimated total wastes from local authorities and other sources going to composting in the UK (2007– 2014)



Data source: 2007-2012: WRAP organic surveys 2007¹, 2008¹, 2009², 2010³, 2012⁴. 2014 LA: Waste Data Flow (England, Wales, NI), ZWS organics survey (Scotland)⁶, 2014 England Total: EA permitted waste, 2014 Other: difference between total and LA.

Materials going to PAS100 certified sites in 2014, were from green waste (2.8 million tonnes), mixed food and green waste (92,434 tonnes), separate food waste²⁸ (22,000 tonnes) and other sources undisclosed by operators (266,000 tonnes) (Figure 23).

Figure 23: Feedstock materials going into PAS100 certified compost, in 2014



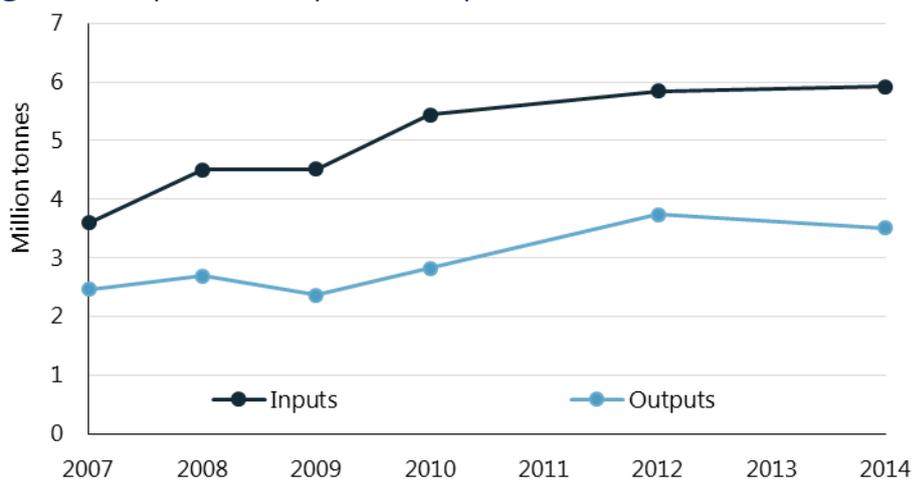
Data source: REAL Certification Scheme for Quality Compost

²⁸ Separate food waste figures appear low; however, food waste is also included in the mixed food and green waste, other and potentially the green waste categories.

3.2.4 Compost output

The 2014 output for permitted sites was estimated, using the average input:output ratio in the five previous surveys²⁹ as there was variability between years, thereby multiplying total inputs of 5.92 million tonnes by 0.59 to get a total UK output 3.51 million tonnes (Figure 24). The output for Scotland reported in the Scottish organics survey was lower than the UK mean, at 0.45 of inputs, where grossed inputs of the 29 sites was 415,506 tonnes, and output was 188,422 tonnes. The output for Wales was 100,000 tonnes as reported by the WRAP Cymru survey undertaken for 2014/15³⁰.

Figure 24: Input and output of compost materials in the UK (2007 – 2014)



Data source: 2007-2012 WRAP organics surveys, 2014: Waste Data Flow and EA Waste Interrogator; ZWS organics survey (Scotland); WRAP Cymru Compost survey 2014/15

Historically, the largest market for compost has consistently been agriculture, and it is likely this market still dominates (60-70%) for all regions. In Scotland the biggest market was agriculture (53%) with a mean market value of £2 per tonne, whereas smaller volume markets secured higher value for quality outputs, including horticulture (£18.50/t), landscape (£14/t), and turf (£13.50/t) (Figure 25) and the grossed market value was estimated to be £871,073 for the 188,422 tonnes of compost produced⁶.

In Wales, agriculture was also the largest market (71,000 tonnes, 71% of total outputs), of which 54,500 tonnes was PAS100 certified and 16,500 tonnes was not certified. Of the remaining 29,125 tonnes of compost that did not go to agriculture, 15,500 tonnes was not-certified and went to landfill restoration, and 13,625 tonnes was PAS100 certified compost and went to a range of markets including bagged, blended soil mix, free to the public, and bulk to landscapers and local authorities (Figure 26). Surveyed composters in Wales reported a range of values for their product, from paying to have compost removed (£2.75 per tonne), to receiving £2 to £5 per tonne on small quantities⁷.

²⁹ WRAP organics surveys 2007, 2008, 2009, 2010, 2012

³⁰ Due to different survey methods the input:output ratios cannot be extrapolated accurately across all regions

Figure 25: End use of compost in Scotland (2014)

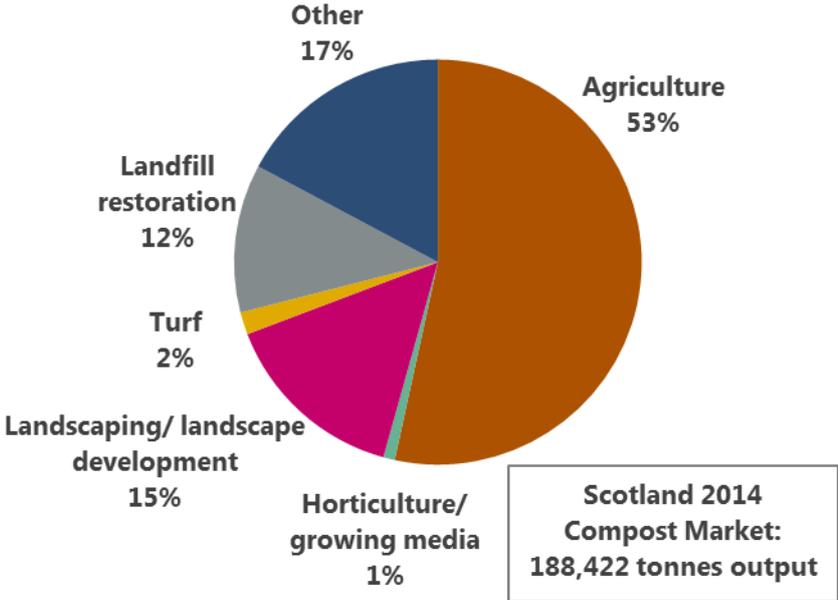
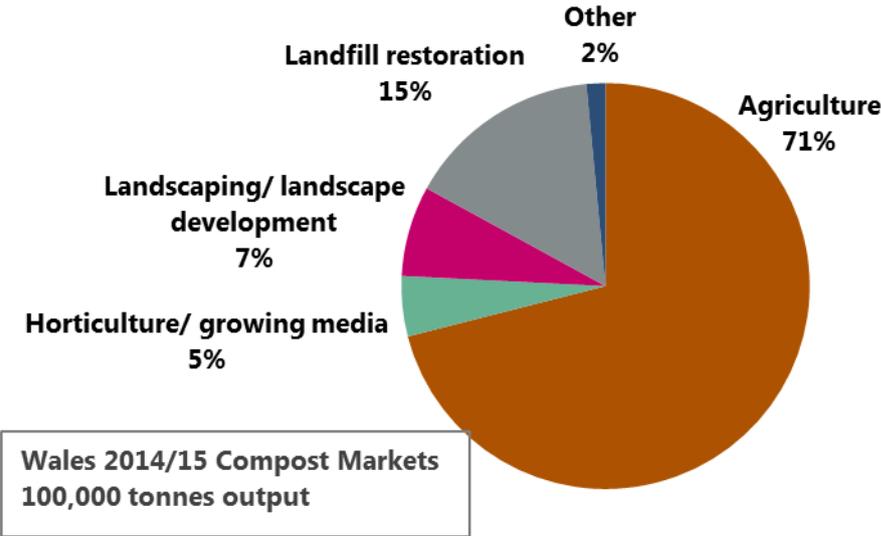


Figure 26: End use of compost in Wales (2014/15)



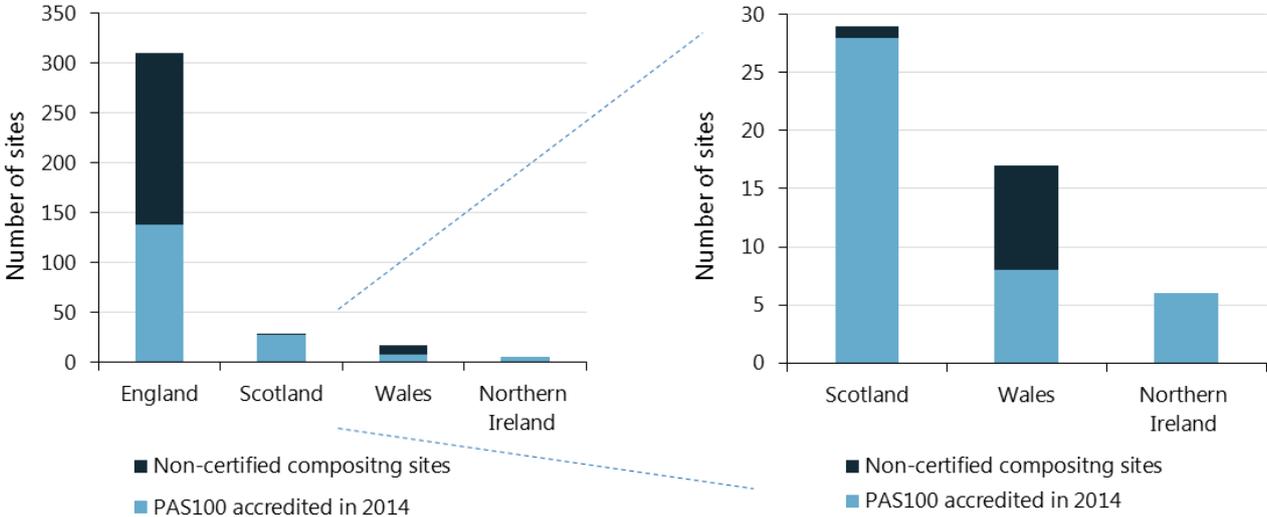
Data source: Scotland⁶ and Wales⁷.

It has not been possible to estimate the total size of UK markets as there is limited data available for England, highlighting a gap in the data collected by industry. Past surveys show agriculture is the dominant market, although data from the quality compost certification scheme indicates around half of compost produced in England was PAS100 certified in 2014, giving producers opportunities to access higher value markets.

There were 180 composting sites on the quality compost certification scheme producing PAS100 compost in the UK in 2014, covering 51% of total permitted sites (Figure 27); however, the volume of certified output is unknown and difficult to estimate in the

absence of a total production figure. The highest proportion of sites with PAS100 was in NI (100%), followed by Scotland (97%), Wales (47%) and England (46%). PAS100 accreditation has increased from 84 sites in 2008, which covered a similar proportion of the sector, 47% of total sites.

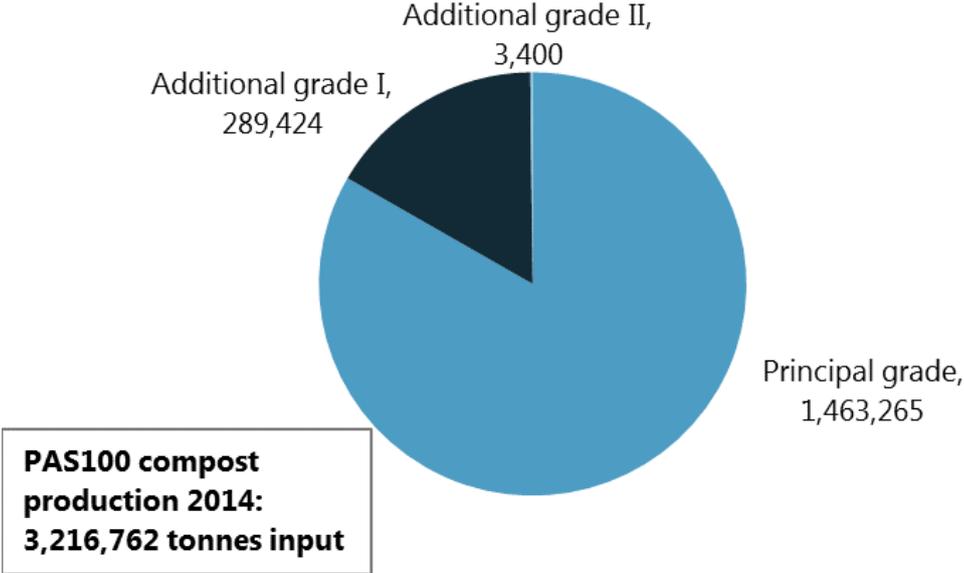
Figure 27: Total compost sites and throughput tonnage, by region, in 2014
(Right-hand chart is an expansion of the cluster of data points in the left-hand chart)



Data source: REAL certification scheme for quality compost

Of the 3.21 million tonnes of input to PAS100 sites, 1.46 million tonnes of product was principal grade (one particular size and market). Some sites diversified to two or three other grades for markets that require a different size/quality to their principal grade. This resulted in the production of a further 289,424 tonnes of additional grade II (different grade to the principal grade, i.e. two grades/markets) and 3,400 tonnes of grade III (different grade to the principal and second grade, i.e. three grades/markets) (Figure 28). Screening to finer grades offers composters access to higher value markets and greater resilience to against fluctuating demand from one market.

Figure 28: PAS100 compost production, by grade, in 2014 (tonnes)



Data source: REAL certification scheme for quality compost

3.2.5 Employees

The number of jobs in composting operations was estimated to be 1,434 in 2014 (Figure 29). This was calculated by taking the average ratio of tonnes of input feedstock against the number of full time jobs reported in previous organics recycling industry surveys and applying it to 2014 input data³¹. This estimation is based on data available from public databases, so that future estimations could be carried out without a full survey, making use of the best data available.

Of the data that was collected for 2014, employment in Scotland was almost identical to 2012, with 138 full time equivalent jobs in 2012 and 139 in 2014. It is difficult to make conclusions about England based on available data. Over time jobs ratios are likely to change, due to factors such as economics and outputs from the previous year, growth or decline in feedstock availability, and market value and demand for compost.

³¹ Only the job ratios from the last three surveys were used, due to fall in employment rate after 2007/8, presumably caused by the recession and the slow rate of economic growth in the UK since then.

Figure 29: Jobs estimated in previous WRAP surveys



Data Sources: 2007-2012: WRAP organics surveys 2007, 2008, 2009, 2010 and 2012. 2014: Scotland: Grossed data from 29 sites from ZWS Scottish Organics survey 2014, England: 10 sites from WRAP organics survey England and Wales 2014, UK: jobs estimated in 2014 multiplying estimated input material with the input material:job ratio in last 3 years.

4. Conclusions

4.1 AD

The AD sector has been growing at a rapid pace, from a nascent industry in 2004 with a handful of plants to becoming an established industry in 2014. The sector has grown markedly in recent years; in 2012 a total of 105 AD plants processed 2.4 million tonnes of organic material providing 120 MWe of installed capacity, and by 2014 a total of 259 AD facilities processed 5.3 million tonnes of material and provided 238 MWe of installed capacity. This trend has the potential to continue with over 500 projects in the pipeline. However, the future deployment rate depends on many factors including policy, incentive mechanisms and associated tariff levels, investor confidence and feedstock availability.

Monitoring of AD deployment is carried out by ADBA, NNFCC, and WRAP. So long as these organisations continue to collect and collate data from the AD sector, information should be available for future analysis. Information on the composting industry has been considerably more difficult to collate through this exercise and data available from Scotland and Wales clearly shows that a more rigorous survey protocol is needed to gain a true picture of the industry.

The majority of feedstocks processed through AD in 2014 were wastes (74%). The largest contribution came from post-consumer food waste (35%), followed by crops (non-waste), other wastes (including commercial and industrial wastes), manure/slurry, and

crop waste. However, feedstocks varied markedly between nations, with Scotland and Wales using more industrial wastes, and Northern Ireland using more crops and manure, compared to England. However, due to the uncertainty around feedstock availability, actual feedstock use may change after planning is approved and over time, which is where the value of information gleaned from planning applications can be limiting and surveys prove more helpful, posing a potential gap for accurate data capture in future years.

In the future, one way to partially fill this gap may be to analyse Ofgem's annual sustainability returns from AD plants. These became mandatory for plants accredited under the Renewables Obligation and Renewable Heat Incentive in October 2015. Declarations of feedstock type and volume are required as part of quarterly and annual declarations and currently summary data is published by Ofgem on which analysis could be undertaken. Plants registered for FITs are still not obliged to report to Ofgem on sustainability of feedstocks, but this may change in the future – in the meantime the data will remain incomplete as not all plants are registered under RO or RHI.

AD receives much less material from local authorities than composting, which received 4-5 million tonnes in 2014. This is because there are large volumes of green waste collected which is more suitable for composting, and less food waste separately collected suitable for AD. Local authorities sent 314,516 tonnes of food waste to AD facilities in Britain; 191,830 tonnes in England, 52,686 tonnes in Wales in 2014/15, and 70,000 tonnes in Scotland in 2014. Therefore, the majority (1.53 million tonnes) of food waste processed by AD facilities in England, Wales and Scotland came from commercial and industrial sources.

An estimated 4.76 million tonnes of food waste are contained in domestic waste (WRAP, Synthesis of food waste compositional data 2014/15³²). Accounting for the 314,516 tonnes already processed through AD as stated above, this leaves a major feedstock source untapped of around 4.45 million tonnes per year. This means there is great potential to increase food waste collections, to help the AD industry grow.

In previous organics recycling surveys the majority of digestate produced on farms was reported to go back to the hosts' own land or given away to neighbours. AD plants not on agricultural sites (industrial and commercial) had greater challenges finding suitable markets for digestate. From the last WRAP AD industry survey in 2013, digestate cost AD businesses up to £13/t for disposal or distribution, however some received up to £3/t in revenue (no data was generated from the current study).

By 2014, 7.3% of all AD sites were PAS110 accredited under the Biofertiliser Certification Scheme, reflecting the underdeveloped status of the digestate market. However, certification has been expanding and increased from 10 sites in 2013, to 42 sites in 2015. This suggests a market for digestate is starting to develop as its nutrient value is being realised and confidence is building in the market. 1 million tonnes of PAS110 certified digestate was produced in 2014, just under a quarter of the estimated 4.6 million tonnes

³² WRAP, *Synthesis of food waste compositional data 2014/15*

of digestate produced. However, the tonnage of digestate accredited by the Biofertiliser Certification Scheme may not be directly comparable to the estimated total digestate production in this report, as the two methods of data collection have different assumptions; for example, NNFCC's database assumes liquid waste contains 10% dry solids. Clearly certification is increasing, along with growth of the sector. The financial value of digestate has become clearer with the publication of WRAP's DC-Agri project, and farmers' gain greater confidence and awareness of its nutrient value.

The AD sector has sustained increasing numbers of jobs, coinciding with the increase in deployment, growing from an estimated 688 jobs in 2013, to 1,007 in 2014 (46% increase on 2013). The creation of new employment is set to continue with significant number of planned plants in the pipeline. The AD jobs coefficient is easy to use for future analysis of the sector, as long as installed electrical capacity (MWe) is known.

4.2 Compost

The compost sector continues to grow, but at a steadier rate, from 271 permitted sites in 2012, to 310 in 2014 and 330 in 2015. This is reflected in processing figures, with 3.6 million tonnes of inputs and 2.46 million tonnes of outputs in 2007, 5.85 million tonnes of inputs and 3.73 million tonnes of outputs in 2012, to 5.92 million tonnes of inputs and 2.5 million tonnes of outputs in 2014. The methodology of data collection changed for 2014, relying on local authority and Environment Agency databases (as opposed to comprehensive survey results) which may not capture all activity; however, it does capture a large proportion of composting activity which may be sufficient for monitoring trends in future years in the absence of a comprehensive industry-wide survey.

Historically, the majority of organic material processed by composting sites has consistently been sourced from local authorities (~85%), and consists mainly of green waste (60-70%) and food waste. As 85% of inputs come from local authorities, it would be helpful for the industry if national reporting of waste management included details of the types and sources of organic materials (green waste/food waste, etc.) and for which type of facilities the materials are destined for processing. Currently reporting is limited to a single figure for 'sent to organics recycling' which includes other types of recycling such as AD, but as AD is a fast a growing sector and is treating similar levels of organic wastes as composts, a categorisation of treatment types would be advisable.

For Wales, Waste Data Flow composting input figures were close to those captured by the survey in Wales⁹ (comparing individual facilities and overall totals), which indicates Waste Data Flow may be sufficient to estimate input volumes in the absence of a survey, although, it is currently very challenging to use Waste Data Flow.

There was limited data on sources of waste diverted to compost facilities from sources other than local authorities, particularly for England, Wales and Northern Ireland. ZWS captured this data in the Scottish survey.

The largest market for compost has consistently been agriculture (60-70%), which holds true in Scotland (53%) and Wales (71%) in 2014. It was not possible to verify this for England due to limited quality data, however it is likely to be similar to Scotland, Wales

and previous years. Improved data on compost markets and end-uses would be helpful, to identify opportunities and challenges around future growth and expansion. It appears compost in Scotland has a higher value than in Wales, with compost values between £13-18 per tonne for horticulture, turf and landscaping, whereas in Wales typical values were £0-5 per tonne, although not all composters disclosed their sale price. It was not possible to draw any firm conclusions from the English markets due to the poor response to our survey. In future it will be difficult to capture this data without a comprehensive survey, showing a gap in publicly available data. However, the compost industry is long established, and markets are unlikely to have changed dramatically in England since 2012.

Quality compost certification is also on the rise, with nearly half of all permitted sites gaining PAS100 accreditation in 2014, increasing from 84 sites in 2008 (47% of total sites), to 180 sites in 2014. Uptake of the PAS100 scheme is markedly more popular in Scotland and Northern Ireland (~100% uptake), compared to England and Wales (~50% of sites). The higher uptake in Scotland and Wales may be due to a different recycling policy, whereby local authorities must send organic waste to certified sites for the input to count towards recycling targets.

The composting industry has a growing workforce, with an estimated 1,434 jobs in 2014 compared to 1,184 in 2009. While using past surveys and feedstock inputs to predict employment rates (as demonstrated in this report) could give a good estimate of job numbers, it will not track any changes in employment rates, such as was seen after the recession.

Appendix 1: Data Sources

The table below lists all data sources used in this report, with a description of the nature and detail of data provided, reporting frequency and a web link to the relevant dataset online. All sources are referenced below each data table throughout the report.

Table 6: Data sources

Data Source	Description of data	Weblink
Local Authorities Waste Management		
Waste Data Flow (UK)	Web based system for municipal waste data annual reporting by UK local authorities to Defra.	http://www.wastedataflow.org/home.aspx
Defra (England)	Waste and recycling statistics	https://www.gov.uk/government/collections/waste-and-recycling-statistics
	Annual Digest of Waste and Resource Statistics – 2015 Edition	https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/422618/Digest_of_waste_England_-_finalv2.pdf
	ENV18 - 2010-2014 - England. Local authority collected waste: annual results tables, including total amounts of wastes collected, and amounts recycled (including organics recycling)	https://www.gov.uk/government/statistical-data-sets/env18-local-authority-collected-waste-annual-results-tables
	ENV19 - Quarterly local authority collected waste management statistics	https://www.gov.uk/government/statistical-data-sets/env19-local-authority-collected-waste-quarterly-tables
	Annual summary of statistics on waste managed by local authorities in England in 2013-2014	https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/375945/Statistics_Notice_Nov_2014_Final_3_.pdf
	Estimates of Commercial and Industrial Waste Generation in England in 2012 - EV0804	http://randd.defra.gov.uk/Default.aspx?Menu=Menu&Module=More&Location=None&ProjectID=19118&FromSearch=Y&Publisher=1&SearchText=ev0804&SortString=ProjectCode&SortOrder=Asc&Paging=10#Description
Welsh Government	Welsh Government statistics page	http://gov.wales/statistics-and-research/?subtopic=Waste&lang=en
	Annual Local authority municipal waste management 2015	http://gov.wales/statistics-and-research/local-authority-municipal-waste-management/?lang=en

Data Source	Description of data	Weblink
	Industrial and commercial waste survey 2009	http://gov.wales/statistics-and-research/industrial-commercial-waste-survey/?lang=en
Scottish Environment Protection Agency (SEPA)	Annual household waste data - 2014	http://www.sepa.org.uk/media/163051/household-waste-summary-data-2014.pdf
Northern Ireland Environment Agency (NIEA)	Environment Statistics page	http://www.doeni.gov.uk/index/information/asb/statistics/environment_statistics.htm#waste-annual
	Northern Ireland local authority collected municipal waste management statistics: Annual Report 2013/14	https://www.daera-ni.gov.uk/articles/published-waste-data
Waste Operators		
Waste Interrogator (Environment Agency)	Annual declarations of quantities and types of waste dealt with - in and out of waste management facilities, from around 6,000 regulated sites.	http://environment.data.gov.uk/ds/catalogue/index.jsp#/catalogue
National Statistics for Energy Output		
Energy Trends, DECC	Quarterly reporting of total/bioenergy/AD electricity output	https://www.gov.uk/government/collections/energy-trends
Digest of UK energy statistics, DECC	Annual reporting of total/bioenergy/AD electricity output	https://www.gov.uk/government/collections/digest-of-uk-energy-statistics-dukes
RHI Deployment Statistics, DECC	Monthly renewable heat generation statistics (inc. biomethane)	https://www.gov.uk/government/collections/renewable-heat-incentive-statistics
AD databases		
ADBA database	Data collected on AD deployment, including number of facilities,	http://adbioresources.org/
NNFCC AD database	feedstocks, electrical and heat outputs	http://www.nnfcc.co.uk/

Data Source	Description of data	Weblink
WRAP AD database		http://www.wrap.org.uk/
Certification Schemes		
Certification Scheme for Quality Composts	Data on certified composting sites in the UK: 172 composting sites with PAS100 accreditation.	http://www.qualitycompost.org.uk/producers
Biofertiliser Certification Scheme	Data on certified digestate sites in the UK: 41 AD sites with PAS110 accreditation.	http://www.biofertiliser.org.uk
Jobs		
UK jobs in the bioenergy sectors by 2020	Method to estimate jobs in AD sector	https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/48341/5131-uk-jobs-in-the-bioenergy-sectors-by-2020.pdf
WRAP Waste Data		
Organics Recycling Industry Surveys	¹ Market survey of the UK organics recycling industry - 2007/08, Association for Organics Recycling ² A study of the UK organics recycling industry in 2008/9, WRAP, 2011 ³ A survey of the UK organics recycling industry in 2010, WRAP, 2012 ⁴ A survey of the UK organics recycling industry in 2012, WRAP, 2013 ⁵ A survey of the UK Anaerobic digestion industry in 2013, WRAP, 2014	http://www.organics-recycling.org.uk/uploads/article1769/WRAP_AFOR_Report_0708_-_FINAL_AFOR_3_cg.pdf http://www.organics-recycling.org.uk/uploads/article1891/Final_AfOR%20annual%20survey.pdf http://www.wrap.org.uk/sites/files/wrap/ASORIFinal%20Report%202010%20v2.pdf http://www.wrap.org.uk/sites/files/wrap/ASORIFinal%20Report%202012.pdf http://www.wrap.org.uk/content/survey-uk-anaerobic-digestion-industry-2013

Data Source	Description of data	Weblink
2014 Organics Recycling Surveys in UK regions	⁶ Zero Waste Scotland survey of the organics industry 2014 ⁷ Survey of green waste compost production capacity in Wales in 2014, WRAP Cymru, 2016	http://www.zerowastescotland.org.uk/content/organics-reprocessing-industry-survey-2014-0 http://www.wrapcymru.org.uk/content/green-waste-compost-sites-wales
Synthesis of food waste compositional data (2014/15)	Provides estimates for total and avoidable household food waste (HHFW) for 2014 and 2015, for the UK.	http://www.wrap.org.uk/hhfw2015

Comments on accessing data

The Environment Agency's Waste Interrogator provides easy access to data about permitted waste management facilities in England, but often the level of detail and explanation of data presented is poor.

Waste Data Flow (WDF) data was difficult to obtain from the online system, or from Defra directly. However, WDF was going through transition in 2014 to simplify the system which could make it more easily accessible. In addition, analysis of WDF for local authority waste management was available, although detail was limited, in annual waste management reports from regional offices: Defra, Scottish Environment Protection Agency (SEPA), Welsh Government and NI Environment Agency.

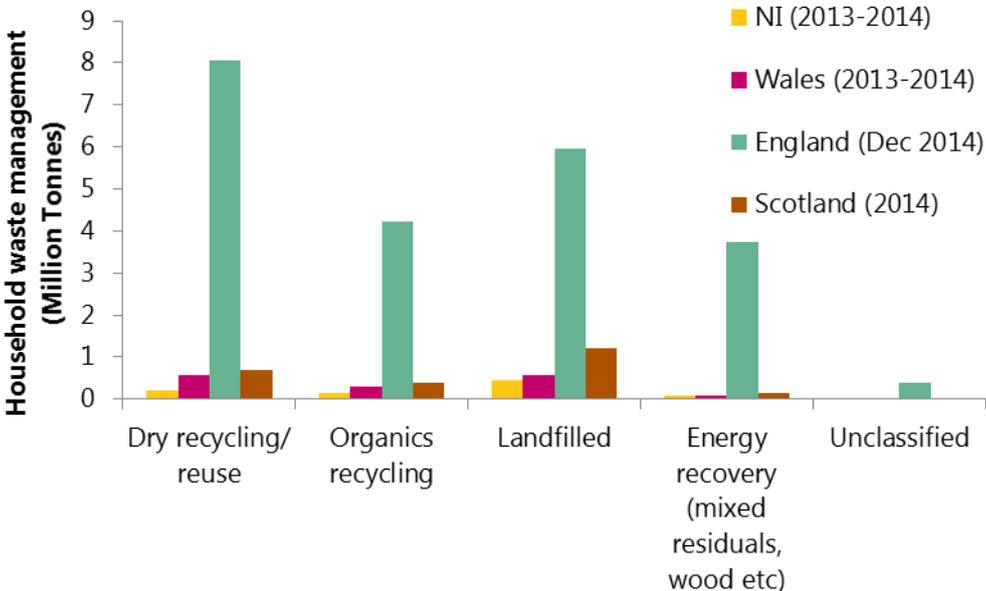
Most Government statistics (Energy Trends, FIT/RHI deployment statistics, DUKES), and past organics recycling market surveys^{1,2,3,4,5} were open access and available online, although often very time consuming to extract meaningful data and trends.

There is limited data from the Quality Compost Certification Scheme and Biofertiliser Certification Scheme publicly available on their website, however if contacted directly both schemes are willing to share data for similar market studies.

Appendix 2: Local Authority (LA) waste management (UK)

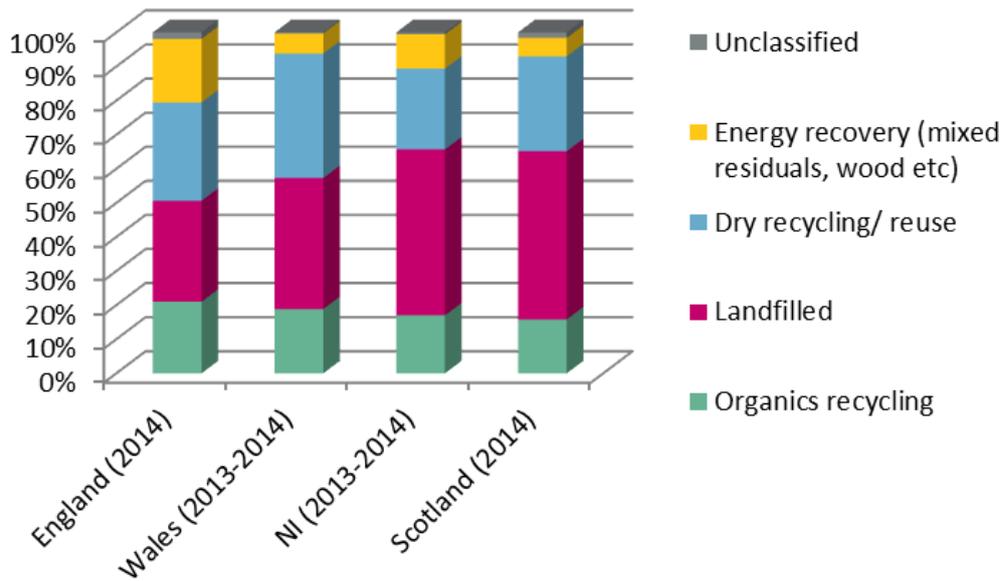
In 2014, local authorities in England managed 22.36 million tonnes per annum (mtpa) of waste, from households and other collections (Defra ENV18) (Figure 30). The total LA waste in Wales was 1.528 million tonnes per annum (Local Authority Municipal Waste Management 2015, Welsh Government statistics for 2013-2014), 2.46 mtpa in Scotland (Household waste – Summary data 2014, SEPA), and 0.925 mtpa in NI (Northern Ireland Local Authority Collected Municipal Waste Management Statistics: Annual Report 2013/14, NEIA). The amount of LA waste sent for organics recycling (including for composting and AD), was 4.22 mtpa (18.9%) in England, 0.288 mtpa (18.8%) in Wales, 0.389 mtpa (15.8%) in Scotland, and 0.218 mtpa (17%) in NI (Figure 31).

Figure 30: Household waste sent to management facilities by local authorities



Data source: Waste Data Flow

Figure 31: Household waste sent to management facilities by local authorities

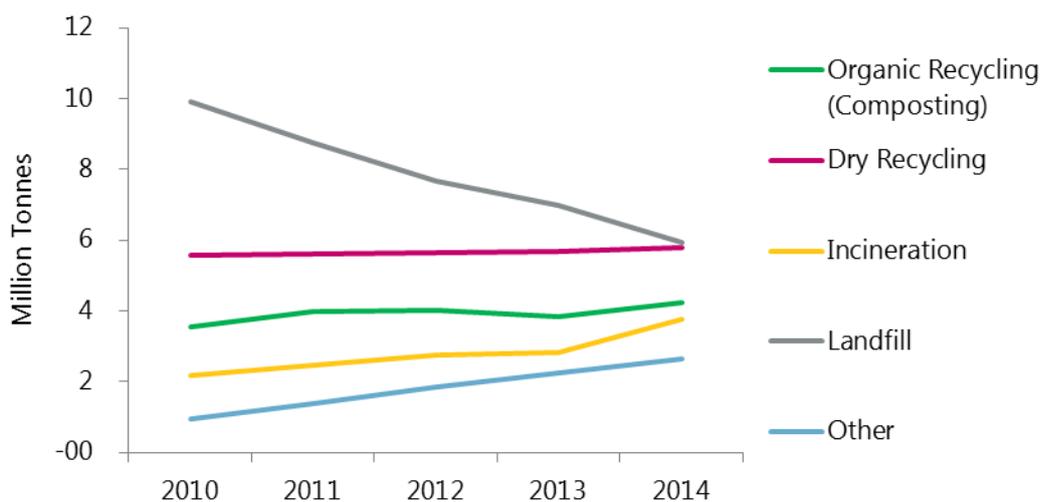


Data source: Waste Data Flow

Local Authority waste management (England)

There has been a sharp decline in landfilling of waste in England in the past few years, from 9.9 million tonnes in 2010 down to 5.9 million tonnes in 2014 (Figure 32). Meanwhile, alternative waste management options have been increasing, including incineration, composting and dry recycling. Organics recycling has increased by 20% since 2010 from 3.5 million tonnes to 4.2 million tonnes in 2014. Separate collection of food waste has also been increasing from 118,000 tonnes in 2010, to 230,000 tonnes in 2012, and 307,317 tonnes in 2014.

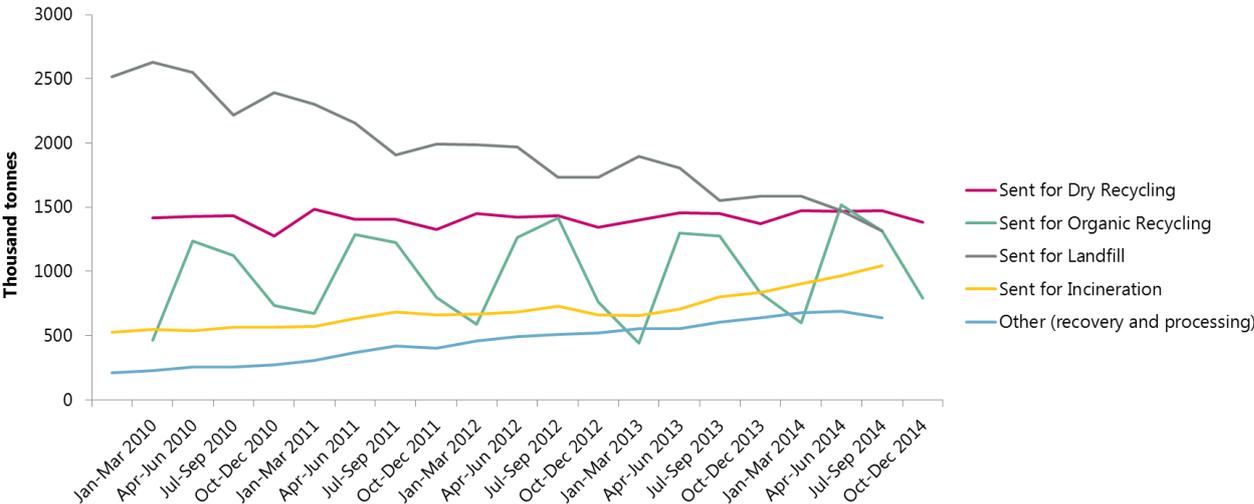
Figure 32: Management of all LA collected waste in England



Data source: ENV19 - Quarterly local authority collected waste management statistics

There is strong seasonal variation of organics recycling across the year, with more than double the amount of waste available in summer months from gardens and trimmings, which is reflected in Figure 33 below. There is also a trend for increased landfilling during winter, compared to summer months, although there still is an overall decline.

Figure 33: Quarterly collection of household waste by Local Authorities in England

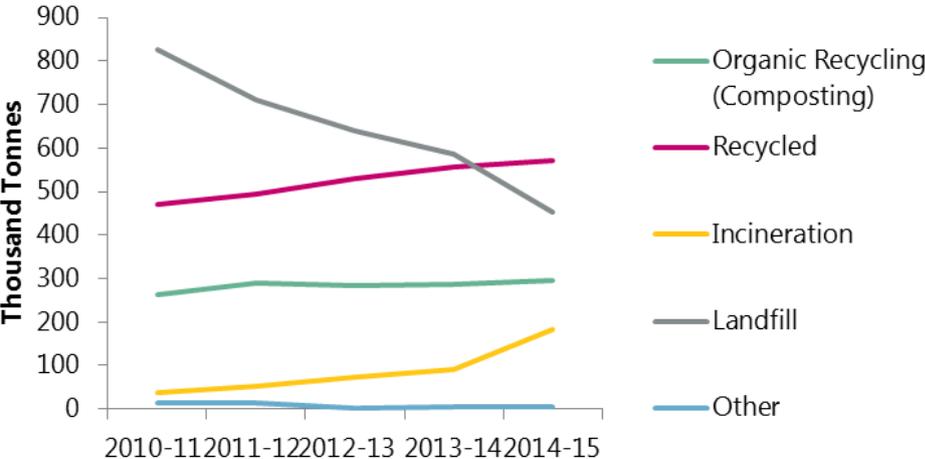


Data source: ENV19 - Quarterly local authority collected waste management statistics

Local Authority waste management (Wales)

In Wales there has been a similarly sharp fall in landfilling of domestic waste, from 826,000 tonnes in 2010 to 453 thousand tonnes in 2014 (45% decrease). Over the same period, waste has been increasingly diverted to incineration (482% increase) and dry recycling (to 38% of total), but also a small rise in organic recycling from 264,000 tonnes in 2010 to 296,000 tonnes in 2014 (12% increase) (Figure 34).

Figure 34: Management of waste by Local Authorities in Wales



Data source: Waste Flow data and Local authority municipal waste management report for Wales, 2014-15

Appendix 3: Compost survey in England

Below are the results from the 2014 compost survey for England (Table 7). It is important to note only 10 sites out of an estimated 310 composting sites were captured in the survey of England. Due to the very low response rate results are not representative of the English composting sector, and are only included here for reference.

Data from the Survey of green waste compost production capacity in Wales, (WRAP Cymru) and Survey of Organics Recycling in Scotland, (Zero Waste Scotland) were representative of the sectors their respective nations and are included in the results section of the main report.

Table 7: Feedstock input to compost in England in 2014 (in tonnes)

Source of input	Percent of total	Response Total	Response Count	Response Average
Local Authority green	72.3%	153,741	9	17,082.33
Local Authority food	0.0%		2	.00
Co-mingled Local	13.3%	28,159	3	9,386.33
Commercial green	7.1%	15,116	6	2,519.33
Commercial food	6.8%	14,500	3	4,833.33
Industrial food waste	0.0%		2	.00
Crop residues	0.0%		2	.00
Other	0.5%	1,000	3	333.33
Total	1	212,516		

Figure 35: Compost Quality Protocol (QP) compliant material production in England in 2014

Compost Quality Protocol	Response Total	Response Count
TOTAL	99,632	9
0 to 10 mm	17,820	5
0 to 11-20 mm	65,812	8
0 to 21-40 mm	21,000	4
Oversize	12,667	6
Other		2

Figure 36: Non Compost Quality Protocol (QP) compliant material produced in England 2014 (in tonnes)

Non Quality Compost Material	Response Total	Response Count
TOTAL	23,816	10
0 to 10 mm		4
0 to 11-20 mm		4
0 to 21-40 mm	12,500	4
Oversize	9,816	3
Other		3

Figure 37: Volume (in tonnes) of compost supplied to markets in England 2014

Markets	Percent of total	Response Total	Response Count	Response Average
Agriculture & field horticulture	46.4%	58,209	8	7,276.13
Horticulture & growing media	22.6%	28,328	6	4,721.33
Landscape development	15.8%	19,820	5	3,964.00
Landfill restoration	12.6%	15,816	3	5,272.00
Energy recovery	0.0%		2	.00
Other	2.6%	3,250	3	1,083.33

Appendix 4: AD Survey Questions

For operators of an anaerobic digestion (AD) facility in England or Wales in 2014:

1. Please confirm the actual volume (in tonnes) of material processed through your AD facility in 2014?

2. How much of your feedstock (in tonnes) in 2014 was:

- Commercial food waste
- Local Authority food waste
- Industrial (solid) food waste
- Industrial (liquid) food/drink waste
- Manure/slurry
- Purpose grown crops
- Crop residues (e.g. outgrades)
- Other

Waste Definitions:

- *Commercial – from households or businesses off-site on a commercial basis (i.e. for a gate fee).*
- *Local Authority – from Council collections or via a Local Authority contract.*
- *Industrial – from an industrial process, typically on-site, e.g. food processing or manufacture*

3. How many employees (full time equivalents) worked for your AD facility in 2014?

4. How much digestate (in tonnes) did you produce in 2014?

- Whole (if unseparated)
- Liquid
- Solid (fibre)

5. How did you process your digestate?

- Did not process
- Mechanical separation
- Drying equipment
- Other (please specify)

6. What volume of digestate (in tonnes) was used in the following markets?

If unsure please provide an estimate and make a note in the comments box on the following question that you have estimated these values.

- Agriculture & field horticulture
- Horticulture & growing media
- Landscape development
- Landfill restoration
- Energy recovery
- Other

7. Would you like to expand on any of your answers or provide further information which would be useful to this survey.

Appendix 5: Compost questionnaire

For operators of a composting site in England or Wales in 2014:

1. Please confirm the actual volume (in tonnes) of material processed by your composting site in 2014?

2. How much of your feedstock (in tonnes) in 2014 was:

- Local Authority green waste
- Local Authority food waste
- Co-mingled Local Authority waste
- Commercial green waste
- Commercial food waste
- Industrial food waste
- Crop residues
- Other

Waste Definitions:

- *Commercial – from households or businesses off-site on a commercial basis (i.e. for a gate fee).*
- *Local Authority – from Council collections or via a Local Authority contract.*
- *Industrial – from an industrial process, typically on-site, e.g. food processing or manufacture*

3. How many employees (full time equivalents) worked at your Composting site in 2014?

4. How much (in tonnes) Compost Quality Protocol (QP) compliant material did you produce in 2014?

If none please enter '0' and move to the next question.

- TOTAL
- 0 to 10 mm
- 0 to 11-20 mm
- 0 to 21-40 mm
- Oversize
- Other

5. How much (in tonnes) non-Compost Quality Protocol (QP) compliant material did you produce in 2014?

If none please enter '0' and ensure you have completed the previous question.

- TOTAL
- 0 to 10 mm
- 0 to 11-20 mm
- 0 to 21-40 mm
- Oversize
- Other

6. What volume (in tonnes) of compost was supplied to the following markets?

If unsure please provide an estimate and make a note in the comments box on the following question that you have estimated these values.

- Agriculture & field horticulture
- Horticulture & growing media
- Landscape development
- Landfill restoration
- Energy recovery
- Other

7. Would you like to expand on any of your answers or provide further information which would be useful to this survey.

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