Department for Environment Food & Rural Affairs

Government Statistical Service

Published 10th December 2015

Area of Crops Grown For Bioenergy in England and the UK: 2008 - 2014

Key Messages

- 122 thousand hectares of agricultural land was used for bioenergy in the UK in 2014.
- The area of crops grown for bioenergy equated to 2% of all arable land in the UK in 2014.
- Just over 68% of land used for bioenergy in 2014 was for biofuel for the UK road transport market.
- 1.2 million tonnes of UK crops were produced for the UK road transport market in 2014/15.
- Maize grown for use in anaerobic digestion accounted for 19% of the total maize area in England in 2015 and 0.7% of England's total arable area.
- Figures relating to biofuel used for road transport in 2014/15 are provisional based on data currently available. This shows that, of the total volume of renewable fuel supplied in 2014/15, 99.6% (1,665 million litres) has so far been demonstrated to meet the sustainability requirements (see Annex B for more details).

The next update to this statistical release is anticipated in Autumn 2016 and will be published at: https://www.gov.uk/government/statistics/announcements?utf8=%E2%9C%93&keywords=&topics%5B%5D=&organisations%5B%5D=department-for-environment-food-rural-affairs&from_date=&to_date=&commit=Refresh+results

Revisions

Section 1: volumes of biofuels supplied to the UK road transport market in 2013/14 have been revised to reflect the final estimates. There have been no other revisions to previously published estimates.

Enquiries on this publication to: Alison Wray, Department for Environment, Food and Rural Affairs, 201 Foss House, Kings Pool, 1-2, Peasholme Green, York YO1 7PX. Tel: 01904 456405. Email: alison.wray@defra.gsi.gov.uk

Contents

Usage of these statistics

Annual estimates of crop areas of oilseed rape, sugar beet, wheat, maize, miscanthus, short rotation coppice and straw crops grown in the UK for use as bioenergy are used by government policy advisors, non-food crop promoters and processors.

Blended in small quantities with fossil fuels, bioethanol (used in petrol) and biodiesel (used in diesel) can be used in today's road vehicles. These biofuels play an important role in the UK plan to meet the target set in the European Renewable Energy Directive 2009 (EU Directive 2009/28/EC http://ec.europa.eu/energy/renewables/biofuels/biofuels_en.htm) for 10% of final energy consumption in the transport sector to be supplied from renewable sources by 2020.

The Renewable Transport Fuels Obligation (RTFO) is one of the Government's main policies for reducing greenhouse gas emissions from road transport in the UK by encouraging the supply of renewable fuels. Obligated suppliers must supply a certain percentage[1] of their road transport fuel as biofuel, or purchase Renewable Transport Fuel Certificates or pay in to the buy-out fund for the shortfall. Further details can be found at: https://www.gov.uk/renewable-transport-fuels-obligation

The use of biofuels also supports other Government objectives to improve security of energy supply and rural development[2].

Data Sources

These statistics, which are from a range of sources, are a secondary analysis of data that have already been published. Although much of the source data are published as National Statistics, there are limitations to these statistics and these are described within each section.

This section gives details of the three main data sources, more detailed information on these and the other sources used can be found in Annex B

- *The June Survey of Agriculture and Horticulture* collects information from farmers on the area of crops grown in the UK at the 1st June each year. In general farmers are not asked about their intended end use for the crops. For crops such as oilseed rape, wheat and sugar beet, where there are multiple end uses, reference has been made to other existing data sources on usage in order to try and establish the crop production and area associated with crops grown for bioenergy by applying appropriate conversion factors to the data collected on biofuel production. In 2014 the June Survey asked farmers to indicate the intended end use of their maize to help determine the proportion intended for used as an anaerobic digestion feedstock.

[1] Rising from 2.5% in 2008/09 to 4.75% from 2013/14 onwards. From 15 April 2013, the end uses covered by the Renewable Transport Fuels Obligation were amended to include non-road mobile machinery (including inland waterways vessels), agriculture and forestry tractors and recreational craft when not at sea (known collectively as NRMM). To keep the supply of biofuel broadly consistent the biofuel target level was changed from 5% to 4.75% based on data supplied by industry on the volume of low sulphur gas oil used for NRMM end uses.

[2] https://www.gov.uk/government/policies/maintaining-uk-energy-security--2 https://www.gov.uk/government/news/15m-fund-for-rural-energy-projects-opens-to-applications

The latest June Survey UK results can be found at:
https://www.gov.uk/government/statistics/farming-statistics-provisional-crop-areas-and-livestock-populations-at-june-2015-united-kingdom

- *Renewable Transport Fuels Obligation data* (collected by the Department for Transport). This data source provides information on the volume of biofuel supplied to the UK road transport market. It includes a breakdown of information by fuel type (e.g. biodiesel, bioethanol) and by feedstock used (e.g. oilseed rape, used cooking oil, sugar beet) and the country of origin of the feedstock. By applying relevant conversion factors, it is possible to derive the equivalent UK crop tonnages used (for oilseed rape, sugar beet and wheat) and UK crop areas.

  Data are supplied by obligated companies supplying more than 450,000 litres of road transport fuel in a given year. These obligated companies supply more than 95% of the biofuels in the UK market. The main limitation of the data is that it does not include UK crops or biofuel produced from UK crops which may be exported and used outside the UK or that goes to end uses other than road transport. Questions included in the latest Renewable Energy STATistics (RESTATS) Questionnaire (see below) help give an indication of the scale of this data gap.

- *Renewable Energy STATistics (RESTATS) Questionnaire* (collected by the Department of Energy and Climate Change - DECC). The purpose of this survey is to determine UK production of biofuels. The published report also includes information on the amount of biofuel supplied to the UK road market and the percentage of biofuel from UK sources. In 2012, the survey also asked questions on the type and origin of feedstocks for the first time. As more information is collected this should provide a useful comparison with data reported under the RTFO (described above) as well as an indication of the volume of UK grown crops which are processed into biofuels for use other than road transport and any that may be produced for export.

Overview of agricultural area used for bioenergy crops

Table 1: Total agricultural area in the UK and areas used for bioenergy crops

Thousand hectares

	2008	2009	2010	2011	2012	2013	2014
Total utilised agricultural area (UAA)[a]	17 703	17 325	17 234	17 172	17 190	17 259	17 240
UAA as a proportion of total UK area	73%	71%	71%	70%	70%	71%	71%
Total arable area[b]	5 900	5 922	5 847	5 931	6 086	6 147	6 115
Wheat of which:	2 080	1 775	1 939	1 969	1 992	1 615	1936
used for bioethanol[c]	0	0	42	6	20	26	53
Barley	1 032	1 143	921	970	1 002	1 213	1 080
used for bioethanol[c]							9
Oilseed rape of which:	598	570	642	705	756	715	675
used for biodiesel[c]	19	22	10	8	3	8	13
Sugar beet of which:	120	114	118	113	120	117	116
used for bioethanol[c]	6	8	12	3	10	8	8
Maize (fodder and grain) of which:	153	163	164	164	158	194	183
used for anaerobic digestion (England only)							29
Short rotation coppice (England only)	6	4	3	3	3	3	3
Miscanthus (England only)	7	9	9	8	8	7	7
Uncropped arable land	194	244	174	156	153	255	160
Temporary grass under 5 years old	1 141	1 241	1 232	1 278	1 357	1 390	1 396
Permanent grassland (incl. sole right rough grazing)	10 395	9 996	9 980	9 858	9 725	9 742	9 755
UK area used for biofuel crops[c][d]	25	30	64	17	32	42	83
Biofuels crops as % of UK arable area [c]	0.4%	0.5%	1.1%	0.3%	0.5%	0.7%	1.3%
UK area used for bioenergy crops[c]	39	43	76	28	42	52	122
Bioenergy crops as % of UK arable area[c]	0.7%	0.7%	1.3%	0.5%	0.7%	0.8%	2.0%

Source: UK Agricultural departments' June Survey/Census of Agriculture.

(a) Includes all arable and horticultural crops, uncropped arable land, common rough grazing, temporary and permanent grassland and land used for outdoor pigs (excludes woodland and other land).

(b) Arable area is defined as the area of arable crops, uncropped arable land and temporary grassland.

(c) 2014 figures are provisional and subject to change.

(d) 2014 total includes a very small area of maize which was processed for bioethanol as part of a trial.

- 122 thousand hectares of agricultural land was used for bioenergy crops in the UK in 2014 comprising: 53 of wheat, 29 of maize, 13 of oilseed rape, 9 of barley, 8 of sugar beet, 7 of miscanthus and 3 of short rotation coppice.
- Arable land used for bioenergy crops in the UK more than doubled in 2014 to account for 2% of the total. This is the highest percentage since 2008 when data were first available.
- Some 68%, or 83 thousand hectares, of the land used for bioenergy in 2014 was for biofuel (biodiesel and bioethanol) crops for the UK road transport market.
- In terms of area, 7% of sugar beet, 3% of wheat, 2% of oilseed rape and 1% of barley was used for biofuel production in the UK in 2014.

1. Biofuels

1.1 UK grown crops used for production of biofuels for supply to the UK road transport market

Table 2 summarises UK sourced biofuels reported under the RTFO (i.e. the biofuels used in the UK that are made from UK feedstocks). Crops and by-products have been included to show how the type of feedstock has changed each year.

Table 2: Volume of UK sourced biofuels supplied to the UK road transport by crop type and waste / residue market, 2008/09 - 2014/15[a] (years relate to 15th April - 14th April)

	UK sourced biofuels used in the UK road transport market (Volume of biofuels million litres or kg[b])							
Fuel type	2008/09	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15	% change 2013/14 - 2014/15
Biodiesel of which:	67.3	101.5	142.5	149.4	173.7	210.1	242.9	16%
Brown grease[c]						0.6	2.0	263%
Oilseed rape	26.3	31.6	14.5	12.8	3.7	9.6	19.3	101%
Tallow (by-product)	5.2	40.0	21.6	6.1	30.3	48.6	62.0	28%
Used cooking oil (by-product)	35.9	29.8	106.4	130.5	139.7	141.7	159.0	12%
Other[d]							0.4	
Bioethanol of which:	41.4	63.9	188.4	39.8	108.1	128.6	252.0	96%
Barley							18.0	
Corn							0.1	
Sugar beet	41.4	63.0	68.5	21.8	59.9	57.8	68.0	18%
Wheat	0.0	0.9	119.9	17.9	48.2	70.8	166.0	134%
Biogas	0.4	0.2	0.4	0.7	1.2	2.1	2.0	-3%
Biomethanol						0.8	0.0	-100%
Pure vegetable oil				0.1	0.2			
Off road diesel						0.7	2.0	172%
Total UK sourced biofuel	109.1	165.6	331.3	190.0	283.2	342.3	498.0	45%
UK sourced biofuels as a proportion of total biofuels used in UK road transport market	9%	11%	22%	12%	21%	20%	30%	

Source: https://www.gov.uk/renewable-transport-fuels-obligation.

(a) 2014/15 figures (Year 7) are as of 5th November 2015 and are subject to revision.

(b) Biodiesel, bioethanol and pure vegetable oil volumes are reported in litres and biogas volumes are reported in kilograms.

(c) Brown grease is fat and oil removed from grease traps and sewers.

(d) "Other" is food waste and soapstock acid oil contaminated with sulphur.

- There was an increase of 45% in UK sourced biofuels used in the UK road transport market in 2014/15, rising to 498 million litres.
- There was a 16% increase in UK sourced biodiesel for UK road transport in 2014/15 to 243 million litres.
- There was a doubling in UK sourced bioethanol for UK road transport in 2014/15 to 252 million litres.
- A large bioethanol plant opened in 2010/11 and another opened in 2013.
- Barley and corn were processed in 2014/15 as part of a trial.

1.2 Implied crop areas based on supply of biofuel to the road transport market

Tables 3 to 7 focus on the arable crops used as feedstocks and translate the biofuel volumes reported under the RTFO into equivalent UK crop areas. These crop areas are only based on biofuel from UK grown crops sold into the UK road fuel market and so do not include UK grown crops which are processed into biofuels and then exported (and not re imported), go to markets other than road transport or are exported to be processed into biofuels elsewhere.

Table 3: Total UK crop areas used for biofuels (biodiesel and bioethanol) supplied to the UK road transport market, 2008/09 - 2014/15

All UK crops used as biofuels (RTFO Year)	Total volume of biofuels from UK grown crops (million litres)	Tonnage of crop implied ('000 tonnes)[(a)]	Area implied '000 ha and % of UK total arable area[(b)]
Year 1: 15 April 2008 - 14 April 2009	67.6	471	25.0 (0.4%)
Year 2: 15 April 2009 - 14 April 2010	95.5	700	30.5 (0.5%)
Year 3: 15 April 2010 - 14 April 2011	202.9	1 039	64.4 (1.1%)
Year 4: 15 April 2011 - 14 April 2012	52.6	295	16.8 (0.3%)
Year 5: 15 April 2012 - 14 April 2013	111.8	733	32.0 (0.5%)
Year 6: 15 April 2013 - 14 April 2014	138.2	787	41.6 (0.7%)
Year 7: 15 April 2014 - 14 April 2015 (prov)[(c)]	271.3	1 226	82.5 (1.3%)

(a) Based on conversions from the Department for Transport and The National Non-Food Crops Centre. Details provided in Table 4.

(b) UK arable area is defined as the area of arable crops, uncropped arable land and temporary grassland as at year n-1. Source: Defra June Survey of Agriculture.

(c) 2014/15 figures (Year 7) are as of 5th November 2015 and are not final. The total volume includes bioethanol produced from UK grown barley and corn which was processed as part of a trial.

- Just over 1.2 million tonnes of UK grown crops were used for biofuel production for the road transport market in 2014/15, an increase of 56% compared to 2013/14 usage.
- An estimated 83 thousand hectares of UK crops were used for biofuels supplied to the UK road transport market which was 1.3% of the total arable area of the UK.

Table 4: conversion factors, litres to tonne of crop

Crop	Litres of biodiesel / bioethanol to 1 tonne of crop
Oilseed rape	429
Sugar beet	101
Wheat	367
Barley	317
Corn	418

Source: Department for Transport https://www.gov.uk/government/publications/rtfo-guidance and The National Non-Food Crops Centre .

Table 5: UK oilseed rape areas used for biodiesel supplied to the UK road transport market, 2008/09 - 2014/15

Oilseed Rape (RTFO Year)	Volume of biodiesel (million litres)			Tonnage of crop implied ('000 tonnes)[c]	OSR yield (t/ha)[d][e]	Area implied '000 ha and % of UK total OSR area[e]
	UK grown crop	of which: on previously cropped land [a]	of which: Voluntary scheme - met land criteria[b]			
Year 1: 15 April 2008 - 14 April 2009	26.3	14.5		61	3.3	18.6 (3%)
Year 2: 15 April 2009 - 14 April 2010	31.6	21.7		74	3.4	21.7 (4%)
Year 3: 15 April 2010 - 14 April 2011	14.5	5.1		34	3.5	9.7 (2%)
Year 4: 15 April 2011 - 14 April 2012	12.8	3.4	1.7	30	3.9	7.6 (1%)
Year 5: 15 April 2012 - 14 April 2013	3.7	1.0	2.7	9	3.4	2.6 (0.3%)
Year 6: 15 April 2013 - 14 April 2014	9.6	5.3	4.4	22	3.0	7.5 (1%)
Year 7: 15 April 2014 - 14 April 2015[f]	19.3	12.7	6.6	45	3.6	12.5 (2%)

Table 6: UK sugar beet areas used for bioethanol supplied to the UK road transport market 2008/9 - 2014/15

Sugar beet (RTFO Year)	Volume of bioethanol (million litres)[g]	Tonnage of crop implied ('000 tonnes)[c]	sugar beet yield (t/ha)[e][h]	Area implied '000 ha and % of UK total sugar beet area[e]
Year 1: 15 April 2008 - 14 April 2009	41.4	409	64	6.4 (5%)
Year 2: 15 April 2009 - 14 April 2010	63.0	624	74	8.4 (7%)
Year 3: 15 April 2010 - 14 April 2011	68.5	678	55	12.3 (10%)
Year 4: 15 April 2011 - 14 April 2012	21.8	216	75	2.9 (3%)
Year 5: 15 April 2012 - 14 April 2013	59.9	593	61	9.8 (8%)
Year 6: 15 April 2013 - 14 April 2014	57.8	572	72	7.9 (7%)
Year 7: 15 April 2014 - 14 April 2015[f]	67.9	672	80	8.4 (7%)

Table 7: UK wheat areas used to produce bioethanol supplied to the UK road transport market 2008/9 - 2014/15

Wheat (RTFO Year)	Volume of bioethanol (million litres)[i]	Tonnage of crop implied ('000 tonnes)[c]	wheat yield (t/ha)[d][e]	Area implied '000 ha and % of UK total wheat area[e]
Year 1: 15 April 2008 - 14 April 2009	0.0	0	8.3	0
Year 2: 15 April 2009 - 14 April 2010	0.9	3	7.9	0.3 (0%)
Year 3: 15 April 2010 - 14 April 2011	119.9	327	7.7	42.4 (2%)
Year 4: 15 April 2011 - 14 April 2012	17.9	49	7.7	6.3 (0.4%)
Year 5: 15 April 2012 - 14 April 2013	48.2	131	6.7	19.7 (1%)
Year 6: 15 April 2013 - 14 April 2014	70.8	193	7.4	26.1 (2%)
Year 7: 15 April 2014 - 14 April 2015[f]	166.1	452	8.6	52.7 (3%)

(a) Previously cropped land is the use of land prior to 1 Jan 2008.

(b) In some cases voluntary schemes recognised by the European Commission as demonstrating compliance with the land criteria do not pass information down the chain of custody on the previous land use of the biofuel, only that the land criteria were met. In these cases it is permitted to report 'voluntary scheme - met land criteria'.

(c) Based on conversions from the Department for Transport. Details provided in Table 4.

(d) Source: Defra annual Cereal and Oilseed Rape Production Survey. UK yield at year n-1.

(e) Source: Defra June Survey of Agriculture. UK area at year n-1

(f) 2014/15 figures (Year 7) are as of 5th November 2015 and are not final.

(g) All sugar beet volumes above were grown on previously cropped land.

(h) Source: British Sugar figures supplied to Defra for the "Agriculture in the UK" annual publication. UK yield at year n-1 https://www.gov.uk/government/collections/agriculture-in-the-united-kingdom

(i) All wheat volumes above were grown on previously cropped land.

- An estimated 12.5 thousand hectares of oilseed rape was used for biodiesel in 2014/15.
- Over 8 thousand hectares of sugar beet were used in the production of bioethanol for the road transport market in 2014/15. Details of sugar beet use for bioenergy can be found at Annex C
- An estimated 53 thousand hectares of wheat was used for biodiesel in 2014/15, double the area in 2013/14. This reflected near full capacity production from both UK plants across most of the period (one plant closed in February 2015).

1.3 Biofuels from crops supplied to the UK for the road transport market 2014/15

Table 8: RTFO volume of biofuel supplied in the UK by crop feedstock and country of origin 2014/15

	Feedstock	Country of origin	Volume of biofuel supplied in UK (million litres)
Biodiesel	Oilseed rape	Austria	3.0
		Bulgaria	1.2
		Czech Republic	0.1
		Denmark	0.0
		France	21.2
		Germany	16.8
		Hungary	0.2
		Latvia	1.1
		Lithuania	1.2
		Poland	4.7
		Romania	4.2
		Russian Federation	1.5
		Slovakia	0.0
		Ukraine	2.0
		United Kingdom	19.3
	Palm	India	0.2
		Indonesia	13.0
		Malaysia	7.1
	Soy	Argentina	0.0

Table 8 continued: RTFO volume of biofuel supplied in the UK by crop feedstock country of origin 2014/15

	Feedstock	Country of origin	Volume of biofuel supplied in UK (million litres)
Bioethanol	Barley	Germany	0.5
		United Kingdom	17.9
	Corn	Belgium	1.0
		Bulgaria	3.1
		France	70.1
		Hungary	15.9
		Netherlands	0.0
		Poland	1.0
		Romania	21.0
		Serbia	8.9
		Spain	81.3
		Ukraine	109.5
		United Kingdom	0.1
		United States	4.0
	Sugar beet	Belgium	2.1
		France	66.9
		Germany	5.2
		United Kingdom	67.9
	Sugar cane	Brazil	7.0
		Costa Rica	4.4
		Guatemala	6.3
		Nicaragua	1.9
		Peru	2.8
	Wheat	Belgium	2.8
		Czech Republic	6.1
		France	52.3
		Germany	2.0
		Hungary	0.0
		Latvia	0.2
		Poland	0.8
		Slovakia	0.4
		United Kingdom	166.1
		United States	0.0
	Total		826.3
	% from UK feedstocks		*33%*

- An estimated 67% of crop derived biofuels for road transport originated from crops grown outside the UK.
- An estimated 33% of crop derived biofuels for road transport originated from crops grown in the UK, more than double the percentage in 2013/14 (15% in 2013/14). See Table 1 for areas by type of crop.

1.4 Comparison of biofuels to all fuels used for road transport

Tables 9 and 10 compare the volume of biofuel used in UK road transport to the total of all fuels supplied for road transport. They also show the proportion of biofuels that are UK sourced. The years run mid-April to mid-April.

Table 9: RTFO Year 6 (2013/14) figures for biofuel from UK feedstocks

	Million litres or kg[a]				
Fuel type	Volume UK sourced biofuels 2013/14	Total volume biofuels supplied to UK 2013/14[b]	Total volume of road transport fossil fuels supplied to UK 2013/14	UK sourced biofuels as a proportion of total biofuels supplied to UK	Biofuels as a proportion of total road transport fuels supplied to UK
Biodiesel of which:	210	861	26 333	24%	3%
Brown grease[c]	1				
Oilseed rape	10				
Tallow (by-product)	49				
Used cooking oil (by-product)	142				
Bioethanol of which:	129	828	17 087	16%	5%
Sugar beet	58				
Wheat	71				
Biogas	2	2		100%	
Biomethanol	1	44		2%	
MTBE (renewable portion)	0	9		0%	
Off road diesel	1	1		78%	
Total	342	1 744	48 673	20%	3.5%[d]
Annual target[e]					4.75%

Source: https://www.gov.uk/government/statistics/biofuel-statistics-year-6-2013-to-2014-report-5

(a) Biodiesel. Bioethanol and pure vegetable oil volumes are reported in litres and biogas volumes are reported in kilograms.

(b) Includes volumes of biofuel from other feedstocks in addition to those listed here e.g. palm oil.

(c) Brown grease is fat and oil removed from grease traps and sewers.

(d) The difference in the percentage shown and the annual target is due to some Renewable Transport Fuel Certificates (RTFCs) being issued to double counting feedstocks. Biofuels produced from wastes, non-agricultural residues, non-food cellulosic material, and ligno-cellulosic material receive two RTFCs per litre/kg meaning suppliers using these feedstock only have to supply half the volume to meet their obligation.

(e) Rising from 2.5% in 2008/09 to 4.75% from 2013/14 onwards. From 15 April 2013, the end uses covered by the Renewable Transport Fuels Obligation were amended to include non-road mobile machinery (including inland waterways vessels), agriculture and forestry tractors and recreational craft when not at sea (known collectively as NRMM). To keep the supply of biofuel broadly consistent the biofuel target level was changed from 5% to 4.75% based on data supplied by industry on the volume of low sulphur gas oil used for NRMM end uses.

- 1,744 million litres of biofuel fuel were supplied to the UK in 2013/14 and 1,671 million litres in 2014/15. The obligation on biofuel fuel supplied for 2013/14 was 2,554 million litres. Obligated suppliers must supply a certain percentage of their road transport fuel as biofuel, or purchase Renewable Transport Fuel Certificates (RTFCs) or pay in to the buy-out fund for the shortfall[3].
- All suppliers met their obligations in full in 2013/14 through the redemption of RTFCs[4].

Data for RTFO years 1 to 5 can be found in previous releases of these statistics at: https://www.gov.uk/government/collections/non-food-crops

[3] Further details can be found at: https://www.gov.uk/renewable-transport-fuels-obligation

[4] https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/401231/rtfo-2013-14-year-6-report-6.pdf

Table 10: RTFO Year 7 (2014/15) provisional figures[a] for biofuel from UK feedstocks

Fuel type	Million litres or kg[b] Volume UK sourced biofuels 2014/15	Total volume biofuels supplied to UK 2014/15[c]	Total volume of road transport fossil fuels supplied to UK 2014/15	UK sourced biofuels as a proportion of total biofuels supplied to UK	Biofuels as a proportion of total road transport fuels supplied to UK
Biodiesel of which:	243	837	27 172	29%	3%
Brown grease[d]	2				
Oilseed rape	19				
Tallow (by-product)	62				
Used cooking oil (by-product)	159				
Other[e]	0.4				
Bioethanol of which:	252	808	16 697	31%	5%
Barley	18				
Corn	0.1				
Sugar beet	68				
Wheat	166				
Biogas	2	2		100%	
Biomethanol	0	22		0%	
HVO (renewable portion)	0	0		0%	
Off road diesel	1	2		100%	
Total	498	1 671	49 211	30%	3.3%[f]
Annual target[g]					4.75%

(a) 2014/15 figures (Year 7) are as of 5th November 2015 and are not final.

(b) Biodiesel. Bioethanol and pure vegetable oil volumes are reported in litres and biogas volumes are reported in kilograms.

(c) Includes volumes of biofuel from other feedstocks in addition to those listed here e.g. palm oil.

(d) Brown grease is fat and oil removed from grease traps and sewers.

(e) "Other" is food waste and soapstock acid oil contaminated with sulphur.

(f) The difference in the percentage shown and the annual target is due to some Renewable Transport Fuel Certificates (RTFCs) being issued to double counting feedstocks. Biofuels produced from wastes, non-agricultural residues, non-food cellulosic material, and ligno-cellulosic material receive two RTFCs per litre/kg meaning suppliers using these feedstock only have to supply half the volume to meet their obligation.

(g) Rising from 2.5% in 2008/09 to 4.75% from 2013/14 onwards. From 15 April 2013, the end uses covered by the Renewable Transport Fuels Obligation were amended to include non-road mobile machinery (including inland waterways vessels), agriculture and forestry tractors and recreational craft when not at sea (known collectively as NRMM). To keep the supply of biofuel broadly consistent the biofuel target level was changed from 5% to 4.75% based on data supplied by industry on the volume of low sulphur gas oil used for NRMM end uses.

1.5 DECC Renewable Energy STATistics (RESTATS) Questionnaire

The Department for Energy and Climate Change (DECC) conduct an annual survey of large scale biofuel production (see Annex B for more details). The survey aims to determine total UK production of biofuels and also combines data on small scale production from HM Revenue and Customs. In 2012, 2013 and 2014, it included questions on the quantity and origin of crops used in UK biofuel production.

Because the survey covers all biofuel production (including that subsequently exported and for markets other than road transport) the data can help build a more complete picture of usage of UK crops for biofuel. Table 11 compares total UK biofuel production to total biofuel supplied to the UK road transport market while Table 12 shows the proportion of UK biofuel production from crop feedstocks and also the proportion of biofuel supplied by end use. Tables 13, 14 and 15 focus on production by individual crop feedstock and implied crop areas.

Table 11: DECC Renewable Energy Survey, UK biofuel production and biofuel supply to UK road transport market, 2010 - 2014

Million litres

	2010	2011	2012	2013	2014
Biodiesel					
Total UK production	175	201	280	300	160
Total biodiesel supplied to UK road transport market	1045	925	634	766	955
Bioethanol					
Total UK production	281	29	154	524	516
Total bioethanol supplied to UK road transport market	631	652	775	820	812

Table 12: DECC Renewable Energy Survey, UK biofuel production and supply (from UK production), 2012 - 2014

	Biodiesel			Bioethanol		
	2012	2013	2014	2012	2013	2014
Total production from crop and waste feedstocks (million litres)	280	300	160	154	524	516
% of production derived from crop feedstocks	5%	44%	0%	100%	100%	100%
% of those crop feedstocks that are UK produced	98%	100%	0%	96%	91%	85%
Total supply from crop and waste feedstocks (million litres)	160	204	156	152	205	534
% of supply to:						
UK road transport	99%	96%	73%	61%	63%	50%
UK Non-Road Transport	0%	0%	1%	1%	6%	0%
UK Heat and Power	1%	1%	1%	0%	0%	0%
Exported[(a)]	na	3%	3%	na	31%	50%
Other	0%	0%	22%	38%	0%	0%

(a) Proportion exported not included as a separate supply category in the 2012 survey.

- UK production of biodiesel dropped by 47% in 2014.
- UK production of bioethanol was hardly changed in 2014, with 50% being exported.

Table 13: DECC Renewable Energy Survey, UK biofuel production and UK feedstocks, 2012

	Total UK biofuel production (million litres)	Biofuel from crop feedstocks (million litres)	Total crop feedstock (thousand tonnes)	% of crop feedstocks produced in the UK	Implied area for UK produced feedstocks (thousand ha) and % of each UK crop area
Biodiesel total	280	14	14	98%	
of which: oilseed rape			14		4 (0.5%)
Bioethanol total	154	154	812	96%	
of which: wheat			228		34(2%)
sugar beet			550		9 (8%)
maize grain[(a)]			34		

Table 14: DECC Renewable Energy Survey, UK biofuel production and UK feedstocks, 2013

	Total UK biofuel production (million litres)	Biofuel from crop feedstocks (million litres)	Total crop feedstock (thousand tonnes)	% of crop feedstocks produced in the UK	Implied area for UK produced feedstocks (thousand ha) and % of each UK crop area
Biodiesel total	300	130	4	100%	
of which: oilseed rape			4		1 (0.2%)
Bioethanol total	524	524	1 045	91%	
of which: wheat			261		35 (2%)
sugar beet			700		10 (8%)
maize grain[(a)]			93		

Table 15: DECC Renewable Energy Survey, UK biofuel production and UK feedstocks, 2014

	Total UK biofuel production (million litres)	Biofuel from crop feedstocks (million litres)	Total crop feedstock (thousand tonnes)	% of crop feedstocks produced in the UK	Implied area for UK produced feedstocks (thousand ha) and % of each UK crop area
Biodiesel total	160	160	0	0%	
of which: oilseed rape			0		
Bioethanol total	516	516	1 859	85%	
of which: wheat			265		79 (4%)
sugar beet			679		8 (7%)
maize grain[(a)]			197		
other crops			89		

(a) Country of origin data are not collected for maize grain or other crops and these are not included in implied area calculations. The UK grows so little grain maize that it is assumed the majority used for biofuels is imported

2. Plant biomass: miscanthus and Short Rotation Coppice

Miscanthus and Short Rotation Coppice (SRC) are grown as energy crops intended for the heat and electricity energy markets. They are burnt in power stations, combined heat and power (CHP) units or heating systems.

2.1 Miscanthus areas

Table 16: Total planted area of miscanthus in England[(a)]

Hectares

English region	2008	2009	2010	2011	2012	2013	2014
North East			0			0	
North West			70			36	
Yorkshire & The Humber			2 100			2 039	
East Midlands			2 503			1 925	
West Midlands			1 013			358	
East of England			642			660	
South East			366			494	
South West			1 964			1 567	
England	7 465	9 213	8 657	8 075	7 517	7 078	7 012
95% confidence interval	*+/- 1 097*	*+/- 2 348*	*+/- 950*	*+/- 807*	*+/- 475*	*+/- 486*	*+/- 555*
Number of growers	335	394	404	398	422	393	569

Source: Defra June Survey of Agriculture and Horticulture.

Defra analysis to produce regional figures and numbers of growers.

(a) Figures prior to 2008 are only available through subsidy scheme information (see below) which may not give a complete picture of all plantings. The Defra experimental stats release published in 2009 gives further details of these historic areas:

- From 2008, official area estimates of miscanthus grown in England are available from the Defra June Survey of Agriculture[5].
- Miscanthus is grown on around 0.1% of the total arable area in England.
- Estimates for number for farms growing miscanthus by area size band in 2013 can be found on page 16 of the 2014 statistical release at: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/434098/nonfood-statsnotice2012-10jun15.pdf Estimates for 2014 are not sufficiently to robust present in size groups given the sample size and associated confidence intervals.
- Subsidy schemes provide a secondary source of area statistics. Farmers can claim subsidies under the Energy Crops Scheme (ECS) to assist with the establishment of miscanthus as part of the Rural Development Programme for England (RDPE). More background on the scheme can be found at Annex B.

[5] The apparent decrease in area from 2009 should be treated with caution as this may be due to the sampling variation in the survey (indicated by the confidence intervals), rather than a genuine decreasing area. Regional crop areas are provided for 2010 when a full census was carried out and 2013 when the survey had an increased sample size; estimates for other years are not sufficiently robust at a regional level given the sample size and associated confidence intervals.

Table 17: Area of Miscanthus new plantings under the Energy Crops Scheme: England

Hectares

English Region	ECS1: 2000-2006/7 area[a]	ECS2: 2008-2015 area[b][c]								ECS2: 2008-2015 total area[c]	Total area claimed under ECS 2000-2015
		2008	2009	2010	2011	2012	2013	2014	2015		
North East	0	0	0	0	0	0	0	0	0	0	0
North West	63	0	0	0	14	14	61	35	0	124	187
Yorkshire & The Humber	1 843	32	43	83	132	102	98	49	39	578	2 421
East Midlands	1 890	45	100	91	119	242	174	23	56	850	2 740
West Midlands	859	24	90	81	180	376	306	8	8	1 072	1 931
East of England	381	0	0	34	83	67	71	41	15	296	677
South East	305	9	36	42	21	42	33	51	0	235	539
South West	1 036	22	211	114	40	21	25	53	20	506	1 542
England total	6 376	132	480	445	589	864	768	260	137	3 675	10 051

(a) ECS1: 2000-2006/7: Summary of area planted and establishment grant payments made for the duration of the scheme. Includes agreements accepted for 2007. Figures from the Natural England website: http://www.naturalengland.org.uk/ourwork/farming/funding/ecs/default.aspx.

(b) ECS2: 2008-2015: Additional area to that under ECS1. Summary of area under agreement. Figures supplied direct from Natural England and show the position at October 2015.

(c) Areas may be subject to change in future.

- The total area of new plantings claimed under subsidies since 2000 is 10,051 hectares. This includes miscanthus being gown at locations other than traditional farms (for example, country parks, and universities). These locations may not be covered by the June Agricultural Survey which recorded a total of just over 7 thousand hectares of miscanthus in 2014.

2.2 Miscanthus yields / production

Much research has been done on miscanthus yields but as yet, no official estimates of achieved yields are available. Yields vary greatly depending on a number of factors such as planting method, species, site conditions, as well as the standard variations of region, annual weather conditions. The first year's growth is not suitable to harvest; the crop reaches maturity at around 5 years and can continue to be harvested for 15-20 years.

Table 18: Miscanthus production based on upper and lower yield estimates[a]

Thousand oven dried tonnes

	2008	2009	2010	2011	2012	2013	2014
Lower estimate	75	92	87	81	75	71	70
Upper estimate	112	138	130	121	113	106	105

Source: Yield information taken from National Non-Food Crops Centre (NNFCC) miscanthus fact sheet at: http://www.nnfcc.co.uk/publications/nnfcc-crop-factsheet-miscanthus and on direct conversations with growers and end users.

(a) Estimates based on areas from the June Survey of Agriculture and Horticulture and yields of 10 to 15 oven dried tonnes per hectare

- Some industry experts estimate that current miscanthus yields average between 12-15 oven dried tonnes (odt) per hectare (equating to 15-18 fresh tonnes per hectare) although other industry bodies suggest a lower figure of 10 odt per hectare.

- The estimated annual volume of miscanthus produced in England based on both the upper and lower yield estimates from industry sources should be treated as broad estimates because of the yield uncertainties and the assumption that the whole of the area planted is productive, which will not be the case for recently planted crops.

2.3 Miscanthus usage

The data are collated by Ofgem as part of sustainability requirements under the Renewables Obligation. There are other outlets for using miscanthus this include horse and livestock bedding, in small scale CHP plants directly on farms for heating buildings and for domestic uses such as wood burners and open fires. Unfortunately, quantitative information on these end uses is not available.

Table 19: Miscanthus usage in UK power stations 2009/10 - 2013/14[(a)]

	Volume used (tonnes)				
Biomass type and form	2009/10	2010/11	2011/12	2012/13	2013/14
Miscanthus total [(b)]	15 561	40 580	44 569	47 414	21 974
Of which:					
Pure Miscanthus	3 705	28 171	33 184	35 136	8733
Miscanthus blend [(c)]	11 857	12 409	11 385	12 278	13 241

Source: Ofgem Renewables Obligations dataset. See Annex B for details

(a) Tonnages are reported directly by the generating stations so it is not known whether these are fresh weight or oven dried equivalents.

(b) Only categories where the proportion of miscanthus was greater than 90% are included.

(c) Blended with either cereal residues or wood.

- Approximately 22 thousand tonnes of miscanthus were used in UK power stations for electricity in 2013/14. This was a decrease of 54% on 2012/13, reflecting a wider trend of declining usage for energy crops; the Renewables Obligation Amendment Order which came into force in April 2013 introduced a number of changes that reduced the incentive for stations to use energy crops[6].
- The volume of miscanthus used in UK power stations was just under a third of all the miscanthus produced in England in 2014, based on low end assumptions of yields.
- The significant increase in miscanthus usage in 2010/11 was due to increasing miscanthus use at Ely power station (while volumes of straw used were reduced).

[6] Section 4, Renewables Obligation Annual Report 2013/14 https://www.ofgem.gov.uk/publications-and-updates/renewables-obligation-ro-annual-report-2013-14 Further information on energy crops can be found in chapter 2 and appendices 3 and 4 of the fuel measurement and sampling guidance: https://www.ofgem.gov.uk/publications-and-updates/renewables-obligation-fuel-measurement-and-sampling-guidance-0

2.4 Short Rotation Coppice (SRC) - willow or poplar areas

Table 20: Total planted area of Short Rotation Coppice grown in England[7]

Hectares

English Region	2008	2009	2010	2011	2012	2013	2014
North East			350			32	
North West			169			129	
Yorkshire & The Humber			911			743	
East Midlands			525			1 032	
West Midlands			71			112	
East of England			82			103	
South East			350			373	
South West			133			127	
England total	6 216	3 721	2 591	2 720	2 551	2 650	2 849
95% confidence interval	*+/- 2 839*	*+/- 1 349*	*+/- 416*	*+/- 768*	*+/- 702*	*+/- 218*	*+/- 503*
Number of growers	373	381	251	228	186	230	182

Source: Defra June Survey of Agriculture and Horticulture

Defra analysis to produce regional figures and numbers of growers.

- SRC (since 2009) represents less than 0.1% of the total arable area in England.
- Since 2009, the picture has been relatively stable. It is suspected that the apparent large fall in area between 2008 and 2009 is due to reduced data robustness in 2008, the first year of this data collection.
- Estimates for number for farms growing SRC by area size band in 2013 can be found on page 19 of the 2014 statistical release at: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/434098/nonfood-statsnotice2012-10jun15.pdf Estimates for 2014 are not sufficiently to robust present in size groups given the sample size and associated confidence intervals.
- A secondary source of area statistics is the Energy Crops Scheme (ECS) subsidy data. Background on the scheme can be found at Annex B.

[7] Regional crop areas are provided for 2010 only when a full census was carried out and 2013 when the survey had an increased sample size; regional estimates for other years are not sufficiently robust given the sample size and associated confidence intervals.

Table 21: Area of SRC new plantings under the Energy Crops Scheme: England

Hectares

English Region	ECS1: 2000-2006/7 area[a]	ECS2: 2008-2015 area[b][c]								ECS2: 2008-2015 total area[c]	Total area claimed under ECS 2000-2015
		2008	2009	2010	2011	2012	2013	2014	2015		
North East	228	0	0	0	0	0	0	0	0	0	228
North West	125	0	0	0	0	0	22	25	0	47	172
Yorkshire & The Humber	464	11	3	29	61	33	2	1	0	140	604
East Midlands	609	49	91	91	34	42	3	3	5	318	927
West Midlands	27	0	0	0	0	0	0	0	26	26	52
East of England	76	0	14	6	21	30	11	0	0	82	158
South East	257	3	15	5	0	0	7	6	3	39	296
South West	31	3	5	2	0	0	0	8	4	22	52
England total	1 815	66	128	133	116	105	45	69	12	674	2 489

a) ECS1: 2000-2006/7: Summary of area planted and establishment grant payments made for the duration of the scheme. Includes agreements accepted for 2007. Figures from the Natural England website: http://www.naturalengland.org.uk/ourwork/farming/funding/ecs/default.aspx.

(b) ECS2: 2008-2014: Additional area to that under ECS1. Summary of area under agreement. Figures supplied direct from Natural England and show the position at September 2014.

(c) Areas may be subject to change in future

- Comparing the total area of new plantings claimed under subsidies since 2000 (2,489 hectares) to the 2014 Defra June Survey area (2,849 hectares) suggests that the vast majority of SRC is grown within the subsidy payment scheme.

2.5 Short Rotation Coppice yields/production

Much research has been done on SRC yields but as yet, no official estimates of achieved yields are available. SRC is harvested every 3-4 years (or more recently, every 2-3 years) and yields vary greatly according to the number of years since planting, site conditions, type of planting method, crop type (willow or poplar) as well as the standard variations of region, annual weather conditions etc.

Table 22: Miscanthus production based on upper and lower yield estimates[a]

Thousand oven dried tonnes

	2008	2009	2010	2011	2012	2013	2014
Lower estimate	37	22	16	16	15	16	17
Upper estimate	75	45	31	33	31	32	34

Source: National Non-Food Crops Centre SRC fact sheet http://www.nnfcc.co.uk/publications/nnfcc-crop-factsheet-short-rotation-coppice-src-willow, Natural England guidance to applicants of ECS http://www.naturalengland.org.uk/Images/short-rotation-coppice_tcm6-4262.pdf,

Forestry Commission guidance
http://www.biomassenergycentre.org.uk/portal/page?_pageid=75,18113&_dad=portal&_schema=PORTAL

(a) Estimates based on areas from the June Survey of Agriculture and Horticulture and yields of 6 to 12 oven dried tonnes per hectare.

- Industry experts at the National Non Food Crops Centre (NNFCC) estimate that SRC yields vary between 25 to 35 oven dried tonnes/ha, equating to an annual yield average of 9.4 odt/ha/yr (taking the average 3 yearly harvest period into account).

- Natural England and the Forestry Commission suggest yields of willow SRC at first harvest are in the range 7-12 odt/ha/yr and the Forestry Commission suggest a likely average yield of poplar in the region of 8 odt/ha/yr. Other industry experts suggest that yields are much lower than these and may be in the region of 6 odt/ha/yr.
- Table 22 shows the estimated volume of SRC produced in England each year based on both the upper and lower yield estimates. These figures should be treated as broad estimates rather than definitive figures as there is much uncertainty behind the estimates
- Total SRC production in England was around 17 thousand tonnes in 2014, based on low end assumptions of yields.

2.6 Short Rotation Coppice usage

The volume of UK produced SRC Willow which was used in power stations is collated by Ofgem, as part of sustainability requirements under the Renewables Obligation. There are few other end uses for SRC.

Table 23: Short Rotation Coppice usage in UK power stations 2009-10 and 2013-14[(a)]

	Volume used (tonnes)				
Biomass type and form	2009/10	2010/11	2011/12	2012/13	2013/14
Short Rotation Coppice total	15 993	14 853	13 927	8 524	6 666
Of which:					
Willow (granules)	2 061	1 848	0	0	0
Willow (dust)	7 363	10 629	5 182	6 784	0
Willow (pellets)	0	243	0	0	4 419
Willow (unknown form)	1 260	0	0	0	0
SRC (wood chips)	5 309	2 133	8 745	1 740	2 274

(a) Tonnages are reported directly by the generating stations so it is not known whether these are fresh weight or oven dried equivalents.

Source: Ofgem Renewables Obligations dataset. See Annex B for details.

- Approximately 7 thousand tonnes of SRC were used in UK power stations for electricity in 2013/14, a reduction of 22% on 2012/13.
- The decrease between 2012/13 and 2013/14 reflects a wider trend of declining usage of energy crops; the Renewables Obligation Amendment Order which came into force in April 2013 introduced a number of changes that reduced the incentive for stations to use energy crops[8].
- The volume of SRC used in UK power stations was around 40% of all the SRC produced in England in 2014, based on low end assumptions of yields.

[8] Section 4, Renewables Obligation Annual Report 2013/14 https://www.ofgem.gov.uk/publications-and-updates/renewables-obligation-ro-annual-report-2013-14 Further information on energy crops can be found in chapter 2 and appendices 3 and 4 of the fuel measurement and sampling guidance: https://www.ofgem.gov.uk/publications-and-updates/renewables-obligation-fuel-measurement-and-sampling-guidance-0

2.7 Volumes of biomass used in the UK for energy

Data from DECC (in the Digest of UK Energy Statistics "DUKES" publication) show the volumes of plant biomass used in the UK for energy (the figures represent the energy content of the fuel used). These figures cover all plant biomass, not just miscanthus and SRC.

As plant biomass comprises a variety of materials, it is not possible to convert these DUKES values from tonnes of oil equivalent to volumes in tonnes. Nevertheless, these data are useful for showing trends in plant biomass usage over time.

Table 24: Trends in plant biomass used in the UK to generate heat and electricity: 2008 to 2014

Thousand tonnes of oil equivalent

	2008	2009	2010	2011	2012	2013	2014	% change 2013/14
Total plant biomass used for heat /electricity	900	1 054	1 357	1 607	1 739	2 404	3 311	38
Of which:								
Used to generate electricity	706	826	1 086	1 317	1 463	2 063	2 938	42
Co-firing with fossil fuels	517	440	625	764	401	54	25	-53
Plant Biomass [a]	189	387	461	554	1 062	2 009	2 913	45
Used to generate heat (plant biomass only)[b]	194	227	271	290	277	341	373	9
Percentage used for electricity	78%	78%	80%	82%	84%	86%	89%	

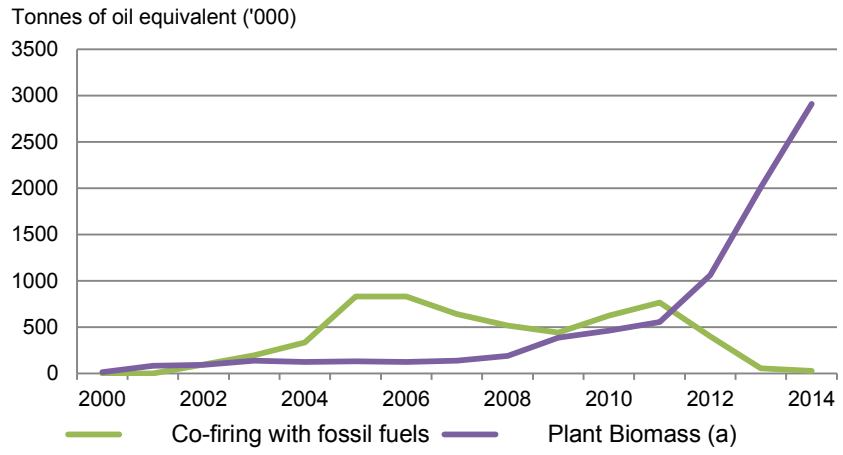
Source: Table 6.6 from Chapter 6 of the DECC Digest of UK Energy Statistics (DUKES) 2015
https://www.gov.uk/government/statistics/renewable-sources-of-energy-chapter-6-digest-of-united-kingdom-energy-statistics-dukes

a) Includes straw combustion and energy crops

b) Includes heat from straw, energy crops, paper and packaging

- Around 80-90% of plant biomass is used for generating electricity.
- There was a 45% increase in the volume of plant biomass used to generate electricity in 2014, reflecting continued conversions from previously coal-fired capacity to biomass, see Figure 1.

Figure 1: Volume of plant biomass used for electricity: 2000 to 2014



Source: Table 6.6 from Chapter 6 of the DECC Digest of UK Energy Statistics (DUKES) 2015

3. Plant biomass: straw

Straw is a by-product of the cereals industry. It is used for animal bedding, as animal feed and, to a small extent, as an energy crop to be burnt for heating and electricity in power stations and combined heat and power (CHP) units.

3.1 UK Straw availability and usage

Table 25: Selected UK cereal areas at June each year

Thousand hectares

	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Wheat	1 867	1 836	1 830	2 080	1 775	1 939	1 969	1 992	1 615	1 936
Barley	938	881	898	1 032	1 143	921	970	1 002	1 213	1 080
Oats	90	121	129	135	129	124	109	122	177	137
Total	2 895	2 839	2 858	3 247	3 047	2 984	3 048	3 116	3 004	3 153

Source: June Survey of Agriculture.

Table 26: UK estimates of cereal straw production based on survey areas and typical straw yields

Thousand tonnes

	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Wheat	6 535	6 426	6 407	7 281	6 214	6 785	6 893	6 972	5 651	6 775
Barley	2 579	2 424	2 469	2 838	3 143	2 533	2 667	2 756	3 336	2 970
Oats	316	425	453	473	452	436	380	427	618	480
Total	9 430	9 275	9 329	10 591	9 809	9 754	9 940	10 154	9 604	10 225

- Table 26 gives some broad estimates of production (yields can vary by up to 30% depending on harvest conditions).
- Cereal straw production is generally around 9 to 10 million tonnes per year with typical yields 3.5 tonnes/ha for wheat and oats and 2.75 tonnes/ha for barley. These yields are based on industry information and qualitative expert opinion. In 2014, Defra's Cereal Production Survey included questions on straw yield for the first time. The 2014 and 2015 results are shown in Table 27 and provide a useful comparison to the industry information.

Table 27: Estimates of cereal straw production, England

		2014	2015
Wheat	Area (thousand hectares)	866	724
	Production (thousand tonnes)	3,527	3,021
	Yield (tonnes per hectare)	4.1	4.2
Barley	Area (thousand hectares)	532	585
	Production (thousand tonnes)	2,037	2,347
	Yield (tonnes per hectare)	3.8	4.0
Oats	Area (thousand hectares)	71	50
	Production (thousand tonnes)	270	196
	Yield (tonnes per hectare)	3.8	3.9
Oilseed rape	Area (thousand hectares)	48	37
	Production (thousand tonnes)	119	115
	Yield (tonnes per hectare)	2.5	3.1

Source: Defra Cereal & Oilseed Production Survey

Table 28: Estimates of cereal straw supply and demand in the UK

UK Supply/Demand	Thousand tonnes	% of cereal straw production	Implied cereal area ('000 ha)[a]
Cereal straw availability[b]	10 400		3 154
Cereal straw usage:			
Animal bedding[b]	5 800	56%	1 758
Animal feed[b]	2 000	19%	606
Mushroom industry[c]	40	0%	12
Carrots[d]	405	4%	123
Power stations[e]	208	2%	63
Surplus cereal straw resource available in the UK for other markets	1 954	19%	590

(a) Area of wheat, barley and oats. Implied areas are calculated as the % of cereal straw production multiplied by the 2014 cereal area.

(b) Tonnages sourced from AEA, 2010: AEA 2010 UK and Global Bioenergy Resource. Annex 1 report: details of analysis http://www.decc.gov.uk/assets/decc/What%20we%20do/UK%20energy%20supply/Energy%20mix/Renewable%20energy/policy/1465-aea-2010-uk-and-global-bioenergy-annex.pdf

(c) Tonnages sourced from CSL, 2008: National and regional supply/demand balance for agricultural straw in Great Britain http://www.nnfcc.co.uk/tools/national-and-regional-supply-demand-balance-for-agricultural-straw-in-great-britain via http://www.northwoods.org.uk/files/northwoods/StrawAvailabilityinGreatBritain.pdf

(d) Agriculture and Horticulture Development Board http://www.ahdb.org.uk/projects/straw.aspx

(e) Tonnages sourced from Ofgem: https://www.ofgem.gov.uk/publications-and-updates/biomass-sustainability-dataset-2013-14

- Around 10 million tonnes of cereal straw is produced in the UK each year. Normally around 60% of the straw produced can be baled and used for other purposes; the remaining stubble is incorporated back into the soil. The two main uses of straw are livestock bedding and feed.
- Around 208 thousand tonnes of straw (2% of total straw production) was used as fuel in biomass power stations in England in 2013/14.
- The figures suggest a net surplus of straw availability in the UK. However, as straw is bulky and costly to transport, much straw usage occurs close to the source so there can be much greater regional variation in the supply/demand balance.
- Regional surpluses of straw occur in the largely arable Eastern regions of the UK. The Western, and typically livestock regions need to bring in straw to meet local demand. More details of regional variation can be found in Section 3.2 at : https://www.gov.uk/government/statistics/area-of-crops-grown-for-bioenergy-in-england-and-the-uk-2008-2012

Table 29: End use of cereal straw England, 2014 and 2015

End usage	% of straw production	
	2014	2015
Home use bedding / feed	40%	51%
Home use biomass	0.3%	0.3%
home use for other purposes	1%	0.5%
Sold / exchanged for feed / bedding	42%	36%
Sold for biomass	5%	3%
Sold for other purposes	11%	9%

Source: Defra, Cereal Production Survey

- In 2014 and 2015, Defra's Cereal Production Survey included questions on the end use of straw. The proportion of straw by use is shown in Table 29.
- Whilst these figures cover England only they broadly in line with the UK estimates in Table 27.

3.2 Power station usage of straw

Table 30: Straw usage in English power stations 2009/10 - 2013/14[(a)]

	Volume used (tonnes)				
Biomass type and form	2009/10	2010/11	2011/12	2012/13	2013/14
Straw total of which:	214 616	195 661	214 690	230 229	208 455
Pellets (Drax, Yorkshire) [(b)]	28 073	47 034	41 184	31 434	7 038
Cereal straw (Ely,	186 543	148 627	173 506	198 795	201 417

Source: Ofgem Annual Sustainability Report. For details see Annex B.

(a) Tonnages are reported directly by the generating stations so it is not known whether these are fresh weight or oven dried equivalents.

(b) In 2010-11, a small quantity was used in Kingsnorth, Kent.

- Data collated by Ofgem as part of sustainability requirements in the Renewables Obligation indicate that in 2013/14, 201 thousand tonnes where used by power stations in England. This was a decrease of 9% compared to 2012/13.
- Several other straw burning power stations have been granted planning permission in recent years. The table below shows the approximate volumes of straw that each intend to use (based on information supplied on the individual websites). All these plants are located in the mainly arable Eastern counties.

Table 31: Potential straw usage in English power stations which have been granted planning permission in recent years

Power station name	When operational (if known)	Planned straw consumption (thousand tonnes)
Sleaford, Lincolnshire	Operational 2014	240
Brigg, East Yorkshire	Operational 2016	240
Tansterne CHP plant, Holderness, East Yorkshire	Planning application approved 2011	66
Snetterton, Norfolk	Operational 2017	na
Wetwang, Yorkshire	Outline planning granted 2013	78
Total		624

Sources:

Sleaford straw power station http://www.sleafordrep.co.uk/

Brigg straw power station http://www.briggrep.co.uk/

Tansterne CHP plant http://www.gb-bio.com/

Snetterton biomass plant http://www.eco2uk.com/en/news_events/news_detail.asp?news_id=309

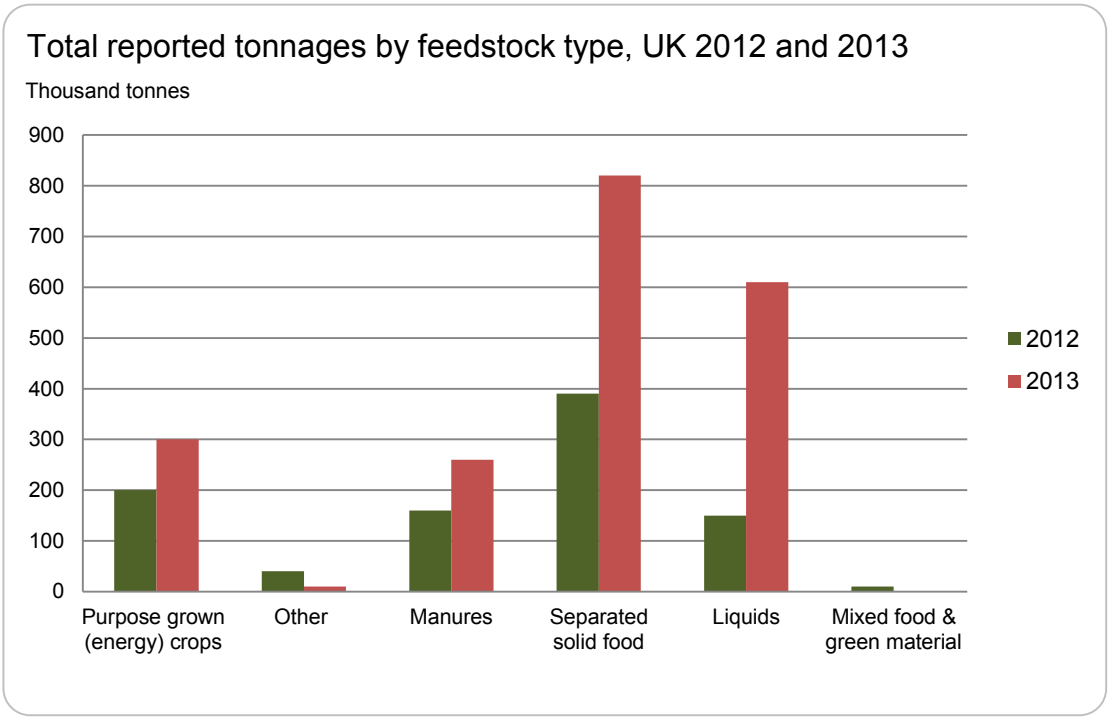
Wetwang: http://www.eastriding.gov.uk/padocs/AUGUST2011/68D93C0E3CB211DF98B4AC53E757C93D.pdf

4. Anaerobic digestion

Waste and purpose-grown crops can be used to produce bioenergy through the process of anaerobic digestion. Anaerobic digestion (AD) is a natural process in which plant and animal materials are converted into useful products by mirco-organisms in the absence of air. The process releases a methane rich gas which can be used to provide heat and power while the remaining material is rich in nutrient and can be used as a fertiliser. The types of materials suitable for AD include food waste, slurry and manure, crops and crop residues.

4.1 Use of purpose grown crops as feedstocks for AD

Figure 2: Reported tonnages of feedstock by type



(Excludes feedstocks for industrial facilities that discharge treated water to sewer)
Source: WRAP A Survey of the UK Organics Recycling Industry in 2012, WRAP Survey of the UK anaerobic Digestion industry in 2013 (see **Annex B** for details)

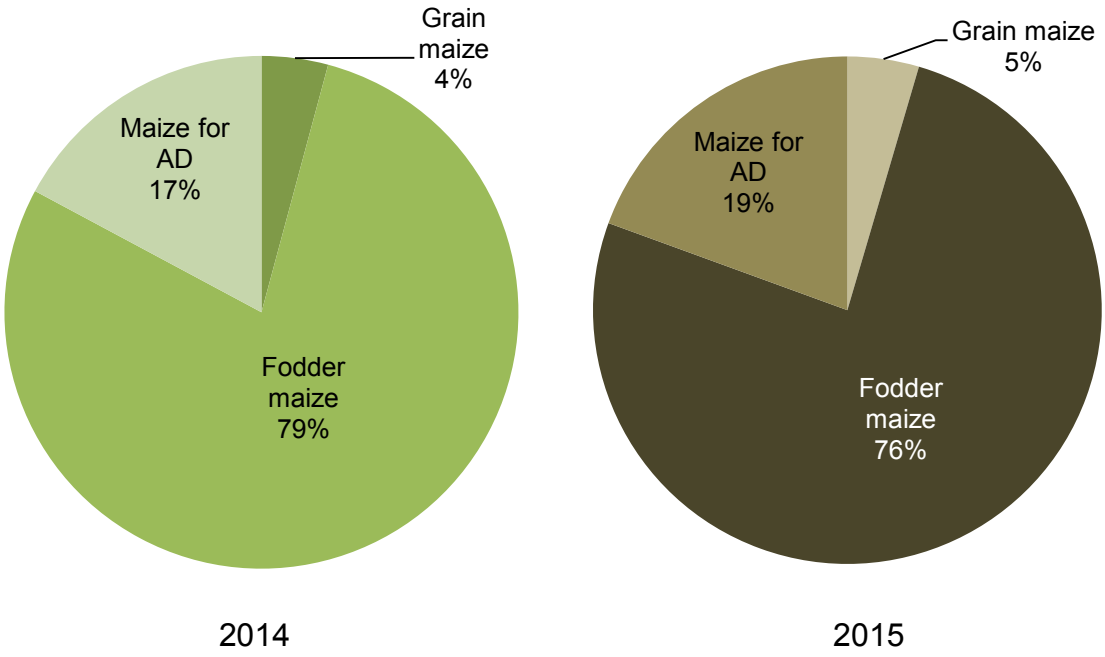
- Reported tonnages of purpose grown crops used as feedstock for AD increased by 50% between 2012 and 2013 to 300 thousand tonnes. This equates to 15% of all AD feedstock.
- There is variation in the feedstocks used across different facility types with farm based sites mainly using purpose grown crops and manures, commercial sites mainly separated food wastes and liquids and industrial sites liquids.
- In 2013, the grossed capacity estimate[9] for on-farm AD sites was just over a million tonnes while the grossed estimate for inputs to on-farm sites was 820 thousand tonnes, a 30% increase on 2012 estimated inputs.

[9] Calculated by grossing up survey responses (to make allowance for sites which did not respond to the survey). These figures are described as "grossed tonnages". Other tonnages reported by the sample of sites responding to the survey are "reported tonnages".

4.2 Types of crops used as feedstocks

Types of crops suitable for use as feedstocks include maize, grass and oilseeds. Official statistics on the amount and type of crops grown used for AD are currently limited to maize. We will be exploring possible ways to gather crop feedstock data in the future.

Figure 3: Maize by intended usage, England



Source: June Survey of Agriculture

- The June Survey of Agricultural and Horticulture asked farmers in England to specify the end purpose of their maize for the first time 2014.
- At June 2015 the area of maize being grown for AD was 33,698 hectares. This was an increase of 15% on 2014 and equates to 19% of the total maize area in 2015 and 0.7% of the total arable area.

Annex A: Glossary of terms and conversion factors

Definition of biodiesel and bioethanol (*Source: Chapter 6, paragraph 6.124 and 6.125 of DUKES* 2015)

In the UK biodiesel is defined for taxation purposes as diesel quality liquid fuel produced from biomass or waste vegetable and animal oils and fats, the ester content of which is not less than 96.5 per cent by weight and the sulphur content of which does not exceed 0.005 per cent by weight or is nil. Bioethanol is defined for taxation purposes as a liquid fuel consisting of ethanol produced from biomass and capable of being used for the same purposes as light oil. For further information, see HMRC Notice179E: Biofuels and other fuel substitutes, October 2009, available at: https://www.gov.uk/government/publications/excise-notice-179e-biofuels-and-other-fuel-substitutes/excise-notice-179e-biofuels-and-other-fuel-substitutes

Diesel fuel currently sold at retail outlets in the UK can contain up to 7 per cent biodiesel. Petrol currently sold at retail outlets in the UK can contain up to 5% bioethanol. Since March 2013 a revised petrol standard (EN228) allows retailers to sell petrol containing up to 10% ethanol by volume (E10), if appropriately labelled[10].

Conversions

- Tonnes of oil equivalent to Gigajoules
  1 tonne of oil equivalent=41.868 Gigajoules (GJ).

  Source DUKES Chapter 1 (Energy) paragraph 1.29.
  https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/447628/DUKES_2015_Chapter_1.pdf

- 2004 - 2014 calorific values of fuels to convert GJ to tonnes are available at:
  https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/448376/dukesi_1.xls

- MJ to litres
  Bioethanol= 23.6 MJ per litre,
  Biodiesel= 34.4 MJ per litre.

  Source: Direct from DECC Energy Statistics team

- Litres to tonnes
  429 litres biodiesel = 1 tonne oilseed rape
  101 litres bioethanol = 1 tonne sugar beet
  367 litres bioethanol = 1 tonne wheat grain (at 15% moisture)
  317 litres of bioethanol = 1 tonne of barley
  418 litres of bioethanol = I tonne of corn

  Source: Department for Transport https://www.gov.uk/government/publications/rtfo-guidance and The National Non-Food Crops Centre

[10] www.gov.uk/government/uploads/system/uploads/attachment_data/file/232126/petrol-protection-extention-ia.pdf

Annex B: Background information on key data sources

B.1 Renewable Transport Fuels Obligation (RTFO)

The Department for Transport (and the Renewable Fuels Agency pre-2011) produce statistics on the volumes of biofuels supplied to the UK road market under the Renewable Transport Fuels Obligation (RTFO). Published reports include information on the volumes of fuel supplied to the UK road market:

- by fuel type (e.g. biodiesel, bioethanol);
- by feedstock (e.g. oilseed rape, used cooking oil, sugar beet);
- by country of origin (e.g. UK); and
- whether it meets sustainability standards and the lifecycle greenhouse gas savings of fuels.

Therefore it is possible to derive information on the volumes of UK grown crops and equivalent crop areas which have been used to supply biofuel to the UK road transport market.

Prior to December 2011 these data were supplied monthly to the RTFO administrator by fuel suppliers and are verified annually. Reports are released quarterly. Verified year 1 (April 2008 to March 2009), verified year 2 (April 2009 to March 2010) are available and verified year 3 (April 2010 to March 2011) data are all available on the Department for Transport website at: https://www.gov.uk/renewable-transport-fuels-obligation.

Since the implementation of the Renewable Energy Directive[11] in December 2011 data must be verified prior to submission to the RTFO Administrator. The verified data for 2011/12 (Year 4) are available at https://www.gov.uk/government/statistics/biofuel-statistics-year-5-2012-to-2013-report-6 And for 2013/12 (Year 5) at https://www.gov.uk/government/statistics/biofuel-statistics-year-5-2012-to-2013-report-6 and for 2013/14 (Year 6) at https://www.gov.uk/government/statistics/biofuel-statistics-year-6-2013-to-2014-report-6

The RTFO data include:

- Biofuels from UK grown and imported crops (these are presented separately in the tables)
- Biofuels supplied to the UK road transport sector
- Data from organisations that supply more than 450,000 litres of road transport fuel in a given year. These obligated companies supply more than 95% of the biofuels in the UK market.
- Data from suppliers of less than 450,000 litres a year where they have chosen to apply for Renewable Transport Fuel Certificates.

The RTFO data exclude:

- UK biofuel or biofuel feedstock production which may subsequently be exported.

[11] This is a European Directive which sets out sustainability criteria which biofuels must meet in order to count towards Member State's targets. These criteria cover protection of land (carbon stocks and biodiversity) and set minimum greenhouse gas savings that increase over time. http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=Oj:L:2009:140:0016:0062:en:PDF

- Producers of less than 450,000 litres of road transport fuel per year who do not claim Renewable Transport Fuel Certificates (RTFCs). However it is not expected that there are many small producers excluded from the RTFO statistics.
- Prior to the implementation of the Renewable Energy Directive[12] (RED) in December 2011, biofuel producers who did not use any fossil fuels (i.e. only supplied biofuels) and did not claim Renewable Transport Fuel Certificates were excluded. For the same reason as above, it is not expected that there were many of these excluded from the RTFO statistics. Following the implementation of the RED only biofuel producers who supply less than 450,000 litres are excluded.

B.2 DECC Renewable Energy STATistics (RESTATS) Questionnaire

To estimate the volume of biofuels produced in the UK from 2010 onwards, the Oil & Gas Statistics Team in DECC carry out an annual renewable energy survey. Neither HMRC or RTFO figures can be used for this purpose since they include both UK produced fuels and imports. Between 2006 and 2015 the survey was carried out by AEA on behalf of DECC Statistics. The production companies are contacted directly in combination with a survey of UK biofuels production capacity that is required by the EU (Reg. 833/2010). The data include estimates for very small scale production (for personal use), though this makes a very small contribution to the totals.

The reports include UK production of biodiesel and bioethanol, the proportion supplied to the UK road market and the percent of biofuel from UK sources together with information on production capacity.

Results or 2010 can be found in DECC/Ricardo-AEA Ltd "RESTATS: UK Production of Biofuels for transport in 2010 - Abstract" at:
https://restats.decc.gov.uk/cms/assets/Uploads/Results_2010/ABSTRACT-UKBiofuelsProduction2010v2.pdf

For 2011 in DECC/Ricardo-AEA Ltd "RESTATS: UK Production of Biofuels for transport in 2011 - Abstract" at: https://restats.decc.gov.uk/cms/assets/Uploads/Results_2011/ABSTRACT-UK-Biofuels-Production-2011v1FINAL.pdf

For 2012 in DECC/Ricardo-AEA Ltd "RESTATS: UK Production of Biofuels for transport in 2012 - Abstract" at: https://restats.decc.gov.uk/cms/assets/Uploads/Results_2012/ABSTRACTS-UK-Biofuels-Production-2012-v1.pdf

Further details on the Liquid Biofuels survey are available on page 7 at:
http://www.decc.gov.uk/assets/decc/statistics/source/renewables/60-renewable-statistics-methodology.pdf

Data from the renewable energy survey also feeds into the Digest of UK Energy Statistics (DUKES) which is again produced by DECC. The digest is a comprehensive source of energy information and can be found at: https://www.gov.uk/government/collections/digest-of-uk-energy-statistics-dukes

[12] This is a European Directive which sets out sustainability criteria which biofuels must meet in order to count towards Member State's targets. These criteria cover protection of land (carbon stocks and biodiversity) and set minimum greenhouse gas savings that increase over time. http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=Oj:L:2009:140:0016:0062:en:PDF

B3. Cereal and Oilseed Rape Production Survey

The Cereal and Oilseed Rape Production Survey gathers data on production tonnages and moisture content for various cereal and oilseed crops. It also verifies data gathered from the June Survey of Agriculture on planted areas for these crops. These data are then used to calculate average yield estimates for each crop type. These were used in calculations of the areas of crops used for biofuel production. In 2014 questions were on straw production and usage where introduced. The latest results from the cereal and oilseed rape production survey can be found at: https://www.gov.uk/government/statistics/farming-statistics-provisional-2015-cereal-and-oilseed-rape-production-estimates-united-kingdom

B4. Energy crops scheme

Farmers can claim subsidies under the Energy Crops Scheme (ECS) to assist with the establishment of miscanthus and short rotation coppice as part of the Rural Development Programme for England (RDPE). This scheme is administered by Natural England and comprises two rounds:

- ECS1 (2000-2006/7) which paid a flat rate to help farmers establish new plantings of the crop.
- ECS2 (2007-2013) which pays 50% of all costs incurred in establishing the crop.

The current Energy Crops scheme closed in 2013 although planting for the scheme can be undertaken in 2013, 2014 and 2015. More details on the scheme are on the Natural England website at: http://www.naturalengland.org.uk/ourwork/farming/funding/ecs/default.aspx.

The Energy Aid Payment Scheme (EAPS), also known as the Aid for Energy Crops Scheme was also offered from 2005 until 2009 but was then subsumed into the Single Payment scheme. EAPS offered farmers €45 per hectare, paid alongside the Single Farm Payment, for producing crops for energy (heat, electricity or transport fuels). This scheme was administered by the Rural Payments Agency. Farmers were able to claim under both EAPS and the ECS for the same crop and it is expected that most claimants would have applied for both payments. The EAPS data is thus not considered in this release as an additional area.

B5. Ofgem Renewable Obligation Annual Report - Biomass Sustainability Dataset (formerly the Annual Sustainability Report)

The concept of sustainability was introduced into the Renewables Obligation (RO) in April 2009 and required operators to submit information on the sustainability of their fuels to Ofgem. The report contains profiling information submitted by the operator regarding the sustainability characteristics of their fuel such as: type of biomass, form of biomass, country of origin and whether it conforms to any environmental quality assurance standards. Datasets for each year are available as follows:

http://www.ofgem.gov.uk/Pages/MoreInformation.aspx?docid=318&refer=Sustainability/Environment/RenewablObl/FuelledStations/ro-sustainability (2010-11 data)

http://www.ofgem.gov.uk/Pages/MoreInformation.aspx?docid=248&refer=Sustainability/Environment/RenewablObl/FuelledStations/ro-sustainability (2009-10 data)

https://www.ofgem.gov.uk/publications-and-updates/annual-sustainability-report-2011-2012 (2011/12 data)

https://www.ofgem.gov.uk/publications-and-updates/biomass-sustainability-dataset-2012-13 (2012/13 data)

https://www.ofgem.gov.uk/publications-and-updates/biomass-sustainability-dataset-2013-14 (2013/14 data)

B6. WRAP Organics Recycling Survey 2012

The WRAP Organics Recycling Survey 2012[13] aimed to quantify the processing of organic wastes in the UK through a survey of key facilities including AD plants. For AD, a telephone survey achieved results from 61 of the 87 sites operational during 2012 (based on information from the official AD Information Portal Map[14] but excluding AD facilities used for waste water treatment). Results were raised to cover non-responding AD plants.

Previous reports have covered 2009 and 2010, but the 2012 AD results are not comparable with 2010 due to methodology changes and the small number of responses in that year. http://www.wrap.org.uk/sites/files/wrap/ASORI%202012.pdf

B7. WRAP Survey of the UK anaerobic Digestion industry in 2013

The purpose of the 2013 study[15] was to quantify the processing of organic material via anaerobic digestion (AD) in the UK using a survey of AD operators. A telephone survey between February and April of 2014 (collecting data on the calendar year 2013) achieved a response rate of 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.

[13] 2012 WRAP Survey of UK Organics Recycling Industry: http://www.wrap.org.uk/sites/files/wrap/ASORI%202012.pdf

[14] Available at: www.biogas-info.co.uk

[15] http://www.wrap.org.uk/content/survey-uk-anaerobic-digestion-industry-2013

Annex C: Background information on crops used for bioenergy

C1. Sugar beet

Production of sugar from beet in the UK is governed by EU regulations, collectively known as the EU sugar regime. In 2006 there was substantial reform of the EU sugar regime, aimed at reducing EU sugar production to more sustainable levels. Key changes included reductions in beet sugar production quotas and changes in the rules applying to any sugar made in excess of the quotas. British Sugar are the sole quota holder in the UK and the reforms led to significant restructuring of their business, with closure of the Allscott and York factories after the 2006/07 campaign and contract tonnage re-allocated to growers closer to the remaining four factories. Furthermore, the UK's first bioethanol plant was constructed at the Wissington factory. Opening in November 2007, it provides an outlet for sugar beet produced above the quota. From 2008/9 onwards the quota has been 1,056,474 tonnes of sugar (equivalent to around 6 million tonnes of sugar beet).

Sugar produced from excess beet would probably previously have been exported to the world market, but these exports are no longer routinely permitted under the reformed regime. Sugar for biofuel, chemical and pharmaceutical industries is excluded from quota.

Data reported under the RTFO have been used to estimate the equivalent tonnage and crop area of sugar beet grown above the quota and diverted to produce bioethanol (Table 6).