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Area of Crops Grown For Bioenergy in England and the UK: 2008 - 2013

Key Messages

- An estimated 51 thousand hectares of agricultural land in the UK were used for bioenergy in 2013.
- The area of crops grown for bioenergy equated to 0.8% of all arable land in the UK in 2013.
- Just over 80% (42 thousand hectares) of the land used for bioenergy in 2013 was for biofuel (biodiesel and bioethanol) crops for the UK road transport market.
- Provisional estimates indicate that 787 thousand tonnes of UK produced crops were used for the UK road transport market in 2013/14.
- In 2014, maize grown for use in anaerobic digestion accounted for 17% (29,373 hectares) of the total maize area in England, which was 0.5% of England's total arable area.

Figures relating to biofuel used for road transport in 2013/14 are provisional based on the data currently available. This shows that, of the total volume of renewable fuel supplied in 2013/14, 99.8% (1,740 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 2015. Once confirmed the exact date will be published on the internet 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

Following advice from The Department for Transport, the conversion factors used to derive crop tonnages are now sourced from the Renewable Transport Fuel Obligation Guidance at: <https://www.gov.uk/government/publications/rfto-guidance>. The new conversion factors have been applied across all years. The revisions are relatively small for wheat and sugar beet but larger for oilseed rape. For a comparison with previous results and conversion factors the please see Tables 3 to 6 at: <https://www.gov.uk/government/statistics/area-of-crops-grown-for-bioenergy-in-england-and-the-uk-2008-2012>

In previous releases, the area of wheat used for biofuel in 2010 included an estimate for the area used to produce bioethanol which was then exported or used for markets other than road transport. This has now been revised to only include areas relating only to Renewable Transport Fuels Obligation data, in line with the approach taken for other years and crops.

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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 percentage¹ 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 development².

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.

¹Rising 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/uploads/system/uploads/attachment_data/file/364157/structure-jun2013prov-UK-16oct14.pdf

- *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
Total utilised agricultural area (UAA) ^(a)	17 703	17 325	17 234	17 172	17 190	17 259
UAA as a proportion of total UK area	73%	71%	71%	70%	70%	71%
Total arable area ^(b)	5 900	5 922	5 847	5 931	6 086	6 147
Wheat of which:	2 080	1 775	1 939	1 969	1 992	1 615
<i>used for bioethanol</i> ^(c)	0	0	42	6	20	26
Barley	1 032	1 143	921	970	1 002	1 213
Oilseed rape of which:	598	570	642	705	756	715
<i>used for biodiesel</i> ^(c)	19	22	10	8	3	8
Sugar beet of which:	120	114	118	113	120	117
<i>used for bioethanol</i> ^(c)	6	8	12	3	10	8
Maize (fodder and grain)	153	163	164	164	158	194
short rotation coppice (England only)	6	4	3	3	3	3
Miscanthus (England only)	7	9	9	8	8	7
Uncropped arable land	194	244	174	156	153	255
Temporary grass under 5 years old	1 141	1 241	1 232	1 278	1 357	1 390
Permanent grassland (incl. sole right rough grazing)	10 395	9 996	9 980	9 858	9 725	9 742
UK area used for biofuel crops ^(c)	25	30	64	17	32	42
Biofuels crops as % of UK arable area ^(c)	0.4%	0.5%	1.1%	0.3%	0.5%	0.7%
UK area used for bioenergy crops ^(c)	39	43	76	28	42	51
Bioenergy crops as % of UK arable area ^(c)	0.7%	0.7%	1.3%	0.5%	0.7%	0.8%

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) 2013 figures are provisional and subject to change

- Approximately 51 thousand hectares of agricultural land in the UK were used for bioenergy crops in 2013 comprising of: 8 thousand hectares of oilseed rape, 8 thousand hectares of sugar beet, 26 thousand hectares of wheat, 7 thousand hectares of miscanthus and 3 thousand hectares of short rotation coppice.
- Overall, the estimated area used for bioenergy crops equated to 0.8% of the planted arable land in the UK in 2013. This had been as high as 1.3% of planted arable land in 2010.
- Just over 80% (42 thousand hectares) of the land used for bioenergy in 2013 was for biofuel (biodiesel and bioethanol) crops for the UK road transport market.
- 1% of the UK oilseed rape area, 7% of the sugar beet area and 2% of the UK wheat area were used for biofuel production in 2013.

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 by-products market, 2008/09 - 2013/14 (years relate to 15th April – 14th April)

Fuel type	UK sourced biofuels used in the UK road transport market (Volume of biofuels million litres or kg ^(a))						% change 2012/13 to 2013/14
	2008/09	2009/10	2010/11	2011/12	2012/13	2013/14 (prov) ^(d)	
Biodiesel of which:	67.3	101.5	142.5	149.4	173.7	199.7	15%
Brown grease ^(c)						0.6	
Oilseed rape	26.3	31.6	14.5	12.8	3.7	9.6	159%
Tallow (by-product)	5.2	40.0	21.6	6.1	30.3	48.4	60%
Used cooking oil (by-product)	35.9	29.8	106.4	130.5	139.7	141.1	1%
Bioethanol of which:	41.4	63.9	188.4	39.8	108.1	128.6	19%
Sugar beet	41.4	63.0	68.5	21.8	59.9	57.8	-4%
Wheat	0.0	0.9	119.9	17.9	48.2	70.8	47%
Biogas (MSW ^(b))	0.4	0.2	0.4	0.7	1.2	2.1	69%
Biomethanol						0.8	
Pure vegetable oil				0.1	0.2		
Off road diesel						0.7	
Total UK sourced biofuel	109.1	165.6	331.3	190.0	283.2	331.9	17%
UK sourced biofuels as a proportion of total biofuels used in UK road transport market	9%	11%	22%	12%	21%	19%	

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

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

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

(c) MSW= Municipal Solid Waste.

(d) 2013/14 figures (Year 6) are as of 6th November 2014 and are subject to revision.

- Provisional figures indicate that UK sourced biofuels used in the UK road transport market increased by 17% between 2012/13 and 2013/14 to 331.9 million litres.
- UK sourced biodiesel used for UK road transport increased by 15% in 2013/14 to 199.7 million litres while UK sourced bioethanol increased by 19% to 128.6 million litres.
- The significant increase in wheat usage (and associated bioethanol production) in 2010/11 was due to the start up of a large bioethanol plant in the UK which has the capacity to produce over 400 million litres of bioethanol a year from over one million tonnes of feed wheat. The plant began production in 2010 but closed temporarily in May 2011 due to market conditions, resulting in the reduced wheat volumes seen in 2011/12. Production restarted in autumn 2012; this was followed by another temporary closure between April 2013 and September 2013. A further bioethanol plant opened in the UK in summer 2013.
- Since 2008/09 there has been an overall decrease in volume of home grown oilseed rape used, reflecting a general movement towards waste feedstocks for biodiesel in the UK market.

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

Tables 3 to 6 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) or go to markets other than road transport.

Table 3: Total UK crop areas (oilseed rape, sugar beet and wheat) used for biofuels (biodiesel and bioethanol) supplied to the UK road transport market, 2008/09 - 2013/14

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 (prov) ^(c)	138.2	787	41.6 (0.7%)

(a) Based on conversions from the Department for Transport. 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) 2013/14 figures (Year 6) are as of 6th November 2014 and are not final.

- 787 tonnes of UK grown crops were used for biofuel production for the road transport market in 2013/14, an increase of 7% compared to 2012/13 usage.
- This equated to an estimated 42 thousand hectares of UK crops used for biofuels supplied to the UK road transport market which is 0.7% of the total arable area of the UK.
- The main driver for the large increase in biofuel production seen between 2011/12 and 2012/13 was the opening of a new bioethanol plant in the summer of 2013 and the reopening (after a temporary closure) of an existing plant in September 2013.

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

Source: Department for Transport <https://www.gov.uk/government/publications/rtfo-guidance>

Table 5: UK oilseed rape areas used for biodiesel supplied to the UK road transport market, 2008/09 - 2013/14

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 ^(f)	9.6	5.3	4.4	22	3.0	7.5 (1%)

Table 6: UK sugar beet areas used for bioethanol supplied to the UK road transport market 2008/9 - 2013/14

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 ^(f)	57.8	572	72	7.9 (7%)

Table 7: UK wheat areas used to produce bioethanol supplied to the UK road transport market 2008/9 - 2013/14

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 (2.2%)
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 ^(f)	70.8	193	7.4	26.1 (2%)

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

(b) Most of the 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) 2013/14 figures (Year 6) are as of 6th November 2014 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 7.5 thousand hectares of oilseed rape was used in the production of biodiesel in 2013/14. This was around 1% of the total UK oilseed rape area and a return to the level seen in 2011/12 although since 2008/09 there has been an overall shift towards the use of waste feedstocks for biodiesel in the UK market.
- Around 8 thousand hectares of sugar beet was used in the production of bioethanol for the road transport market in 2013/14. The significantly lower usage/areas seen in RTFO Year 4 (2011/12) were the result of lower production due to adverse weather conditions in 2010. This led to reduced availability with less sugar beet for biofuel production. Yields recovered in 2011, exceeding the previous high achieved in 2009. More background on sugar beet use for bioenergy can be found at [Annex C](#)
- The area of UK grown wheat processed into bioethanol increased from just under 20 thousand hectares in 2012/13 to 26 thousand hectares in 2013/14 reflecting the opening of a new processing plant and reopening of an existing plant during that period.

1.3 Biofuels from crops supplied to the UK for the road transport market 2013/14

Table 8: RTFO volume of biofuel supplied in the UK by crop feedstock and country of origin 2013/14

Feedstock	Country of origin	Volume of biofuel supplied in UK (million litres)	
Biodiesel	Argentina	0.2	
	Australia	2.7	
	Belgium	2.3	
	Bulgaria	0.8	
	Czech Republic	0.2	
	Denmark	0.0	
	France	4.4	
	Germany	13.0	
	Hungary	1.2	
	Indonesia	0.0	
	Latvia	3.0	
	Lithuania	0.3	
	Malaysia	0.0	
	Norway	0.0	
	Poland	7.4	
	Romania	0.4	
	Ukraine	1.9	
	United Kingdom	9.6	
	Palm	Indonesia	31.0
		Malaysia	6.1
Soy	Argentina	20.9	
	Paraguay	6.1	

Table 8 continued: RTFO volume of biofuel supplied in the UK by crop feedstock country of origin 2013/14

Feedstock	Country of origin	Volume of biofuel supplied in UK (million litres)
Corn	Belgium	2.9
	Bulgaria	12.4
	Czech Republic	1.0
	France	97.7
	Germany	3.3
	Hungary	37.8
	Poland	3.4
	Romania	13.7
	Slovakia	2.0
	Spain	41.5
	Turkey	3.6
	Ukraine	138.4
	United States	66.4
Sugar beet	Belgium	5.1
	France	70.5
	Netherlands	2.6
	United Kingdom	57.8
Sugar cane	Bolivia	0.1
	Brazil	23.3
	Costa Rica	7.2
	Guatemala	6.1
	Nicaragua	2.6
	Peru	34.8
United States	0.1	
Wheat	Belarus	0.5
	Belgium	20.0
	France	70.8
	Germany	2.7
	Poland	0.1
	Spain	11.5
	United Kingdom	70.8
Total biodiesel and bioethanol		810.3
% from UK feedstocks		15%

- Provisional figures for 2013/14 indicate that 85% of crop derived biofuels for road transport originated from crops grown outside the UK, while 15% of originated from crops grown in the UK.
- The 15% originating from UK crops equates to an area of 42 thousand hectares which is 0.7% of the arable area in the UK (see Table 3).

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. Data for RTFO years 1 (2008/09) to 4 (2011/12) can be found in Tables 10 to 13 at: <https://www.gov.uk/government/statistics/area-of-crops-grown-for-bioenergy-in-england-and-the-uk-2008-2012>

Table 9: RTFO Year 5 (2012/13) figures for biofuel from UK feedstocks

Fuel type	Million litres or kg ^(a)			UK sourced biofuels as a proportion of total biofuels supplied to UK	Biofuels as a proportion of total road transport fuels supplied to UK
	Volume UK sourced biofuels 2012/13	Total volume biofuels supplied to UK 2012/13 ^(b)	Total volume of road transport fossil fuels supplied to UK 2012/13		
Biodiesel of which:	174	493	25 833	35%	1.1%
Oilseed rape	4				
Tallow (by-product)	30				
Used cooking oil (by-product)	140				
Bioethanol of which:	108	782	17 466	14%	1.8%
Sugar beet	60				
Wheat	48				
Biogas (MSW ^(c))	1	1		100%	0.0%
Biomethanol	0	35		0%	0.1%
MTBE (renewable portion)	0	28		0%	0.1%
Pure vegetable oil	0.2	0.2		100%	0.0%
Total	283.2	1 340	43 366	21%	3.0%
Annual target					4.5%

Source: <https://www.gov.uk/government/statistics/biofuel-statistics-year-5-2012-to-2013-report-6>

(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) MSW= Municipal Solid Waste.

- 1,340 million litres of biofuel fuel were supplied to the UK in 2012/13 and 1,744 million litres in 2013/14.
- The obligation on biofuel fuel supplied for 2012/13 was 2,044 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 shortfall³. All suppliers met their obligations in full in 2012/13 through the redemption of RTFCs⁴.

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

⁴ <https://www.gov.uk/government/statistics/biofuel-statistics-year-5-2012-to-2013-report-6>

Table 10: RTFO Year 6 (2013/14) provisional figures for biofuel from UK feedstocks

Fuel type	Million litres or kg ^(a)			UK sourced biofuels as a proportion of total biofuels supplied to UK	Biofuels as a proportion of total road transport fuels supplied to UK
	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		
Biodiesel of which:	200	861	26 333	23%	1.7%
Brown grease ^(c)	0.6				
Oilseed rape	10				
Tallow (by-product)	48				
Used cooking oil (by-product)	141				
Bioethanol of which:	129	828	17 087	16%	1.6%
Sugar beet	58				
Wheat	71				
Biogas (MSW ^(d))	2	2		100%	0.0%
Biomethanol	1	44		2%	0.1%
MTBE (renewable portion)	0	9		0%	0.0%
Off road diesel	1	1		78%	0.0%
Total	331.9	1 744	50 420	19%	3.5%
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) MSW= Municipal Solid Waste.

(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.

1.5 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 and 2013, 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 and 14 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 - 2013

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

Table 12: DECC Renewable Energy Survey, UK biofuel production and supply (from UK production), 2012 and 2013

	Biodiesel		Bioethanol	
	2012	2013	2012	2013
Total production from crop and waste feedstocks (million litres)	280	300	154	524
% of production derived from crop feedstocks	5%	44%	100%	100%
% of those crop feedstocks that are UK produced	98%	100%	96%	91%
Total supply from crop and waste feedstocks (million litres)				
% of supply to:				
UK road transport	99%	96%	61%	63%
UK Non-Road Transport	0%	0%	1%	6%
UK Heat and Power	1%	1%	0%	0%
Exported ^(a)	na	3%	na	31%
Other	0%	0%	38%	0%

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

- UK Production of bioethanol more than tripled in 2013 compared to 2012 while UK production of biodiesel showed a comparatively small increase of just 7% between the 2 years.
- In 2013, 31% of bioethanol produced in the UK was exported while only 3% of biodiesel was 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		

(a) Country of origin data are not collected for maize grain. 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 15: Total planted area of miscanthus in England^(a)

	Hectares					
English region	2008	2009	2010	2011	2012	2013
North East			0			0
North West			70			36
Yorks and Humberside			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
<i>95% confidence interval</i>	<i>+/- 1 097</i>	<i>+/- 2 348</i>	<i>+/- 950</i>	<i>+/- 807</i>	<i>+/- 475</i>	<i>+/- 486</i>
Number of growers	335	394	404	398	422	393

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 Agriculture⁵.
- Miscanthus is grown on around 0.1% of the total arable area in England.
- 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 16: Area of Miscanthus new plantings under the Energy Crops Scheme: England

English Region	ECS1: 2000- 2006/7 area ^(a)	ECS2: 2008-2014 area ^{(b)(c)}							ECS2: 2008-2014 total area ^(c)	Hectares Total area claimed under ECS 2000-2014
		2008	2009	2010	2011	2012	2013	2014		
North East	0	0	0	0	0	0	0	0	0	0
North West	63	0	0	0	14	14	61	0	89	152
Yorks & Humberside	1 843	32	43	83	132	102	98	16	506	2 349
East Midlands	1 890	45	100	91	119	242	174	13	784	2 674
West Midlands	859	24	90	81	180	376	306	8	1 065	1 924
East of England	381	0	0	34	83	67	71	9	264	645
South East	305	9	36	42	21	42	33	0	183	488
South West	1 036	22	211	114	40	21	25	19	452	1 488
England total	6 376	132	480	445	589	864	768	65	3 343	9 719

(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.

- The total area of new plantings claimed under subsidies since 2000 is 9,719 hectares. This includes miscanthus being grown 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 2013.

2.2 Size of farms growing miscanthus

Table 17: Numbers and areas of farms with Miscanthus by size band: England 2013

Area of Miscanthus	Number of farms	Area of Miscanthus (hectares)	% of Miscanthus farms	% of Miscanthus area
0.1 to less than 5 hectares	85	219	22	3
5 to less than 10 hectares	85	637	22	9
10 to less than 20 hectares	106	1 496	27	21
20 to less than 50 hectares	94	2 692	24	38
50 hectares and over	23	2 033	6	29
England total	393	7 078	100	100

Source: Defra June Survey of Agriculture and Horticulture, 2013.

Defra analysis to produce size group areas and numbers of growers.

- In 2013 there were around 400 miscanthus growers.
- Just under one third (30%) of growers have at least 20 hectares of miscanthus and so are undertaking quite large scale projects. These farms account for 67% of the total miscanthus area.

2.3 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 estimates, based on upper and lower yield estimates (averaged across all factors affecting yield)

Year	Area (ha)	Yield (odt/ha)	Production range (thousand oven dried tonnes)	
			lower	upper
2008	7 465	10-15	75	112
2009	9 213	10-15	92	138
2010	8 657	10-15	87	130
2011	8 075	10-15	81	121
2012	7 517	10-15	75	113
2013	7 078	10-15	71	106

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.

- 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.

2.4 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 known to be available.

Table 19: Miscanthus usage in UK power stations 2009/10 - 2012/13^(a)

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

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 47 thousand tonnes of miscanthus were used in UK power stations for electricity in 2012/13. This was an increase of 6% on 2011/12.
- The volume of miscanthus used in UK power stations was around two thirds of all the miscanthus produced in England in 2013, 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).
- There is still a substantial difference between power station usage and potential production. This may in part be explained by more recent plantings (see Table 16) not having reached productive maturity for use in the power plants.

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

Table 20: Total planted area of Short Rotation Coppice grown in England⁶

English Region	2008	2009	2010	2011	2012	2013
North East			350			32
North West			169			129
Yorks & Humberside			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
<i>95% confidence interval</i>	<i>+/- 2 839</i>	<i>+/- 1 349</i>	<i>+/- 416</i>	<i>+/- 768</i>	<i>+/- 702</i>	<i>+/- 218</i>
Number of growers	373	381	251	228	186	230

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.
- A secondary source of area statistics is the Energy Crops Scheme (ECS) subsidy data. Background on the scheme can be found at [Annex B](#).

⁶ 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

English Region	ECS1: 2000- 2006/7 area ^(a)	ECS2: 2008-2014 area ^{(b)(c)}							ECS2: 2008-2014 total area ^(c)	Total area claimed under ECS 2000-2014
		2008	2009	2010	2011	2012	2013	2014		
North East	228	0	0	0	0	0	0	0	0	228
North West	125	0	0	0	0	0	22	4	26	151
Yorks & Humberside	464	11	3	29	61	33	2	1	140	604
East Midlands	609	49	91	91	34	42	3	0	310	919
West Midlands	27	0	0	0	0	0	0	0	0	27
East of England	76	0	14	6	21	30	11	0	82	158
South East	257	3	15	5	0	0	7	3	33	290
South West	31	3	5	2	0	0	0	8	18	49
England total	1 815	66	128	133	116	105	45	16	609	2 424

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 (2,424 hectares) to the 2013 Defra June Survey area (2,650 hectares) suggests that the vast majority of SRC is grown within the subsidy payment scheme.

2.6 Size of farms growing Short Rotation Coppice

Table 22: Numbers and areas of farms with SRC by size band: England 2013

Area of SRC	Number of farms	Area of SRC (hectares)	% of SRC farms	% of SRC area
0.1 to less than 2 hectares	69	46	30	2
2 to less than 5 hectares	43	143	19	5
5 to less than 10 hectares	36	252	16	10
10 to less than 20 hectares	46	606	20	23
20 hectares and over	36	1 603	16	60
England total	230	2 650	100	100

Source: Defra June Survey of Agriculture and Horticulture, 2013

Defra analysis to produce size group areas and numbers of growers

- The 2013 June Agricultural Survey estimates there were around 230 SRC growers in England.
- A small number of growers produce the majority of SRC; 16% of SRC growers accounted for over half the national area.
- Around a third of SRC growers (accounting for just 46 hectares) have very small areas (less than 2 hectares each). The minimum area required to claim ECS subsidies is 3 hectares so it is unlikely that these growers would be claiming subsidy payments to assist with crop establishment.

2.7 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 23: Short Rotation Coppice production estimates, based on upper and lower yield estimates (averaged across all factors affecting yield)

Year	Area (ha)	Yield (odt/ha)	Production range (thousand oven dried tonnes)	
			lower	upper
2008	6 216	6-12	37	75
2009	3 721	6-12	22	45
2010	2 591	6-12	16	31
2011	2 720	6-12	16	33
2012	2 551	6-12	15	31
2013	2 650	6-12	16	32

(a) 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

- 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 24 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 16 thousand tonnes in 2013, based on low end assumptions of yields.

2.8 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 24: Short Rotation Coppice usage in UK power stations 2009-10 and 2012-13^(a)

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

(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 9 thousand tonnes of SRC were used in UK power stations for electricity in 2012/13, a reduction of 39% on 2011/12.
- The 2012/13 drop in volume reflects a lower or nil usage of SRC by some power stations.
- Prior to 2012/13 the volumes recorded here are slightly below the lower end of production levels estimated in the previous table, as with miscanthus, more recent plantings will not yet have reached maturity to harvest so would not be included in the usage data.

2.9 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 25: Trends in plant biomass used in the UK to generate heat and electricity: 2000 to 2007

	Thousand tonnes of oil equivalent							
	2000	2001	2002	2003	2004	2005	2006	2007
Total plant biomass used for heat /electricity	83	153	258	406	530	1 052	1 055	888
Of which:								
Used to generate electricity	11	81	186	334	458	960	952	779
Co-firing with fossil fuels	0	0	94	197	335	831	829	641
Plant Biomass ^(a)	11	81	92	137	123	129	123	138
Used to generate heat (plant biomass only) ^(b)	72	72	72	72	72	92	103	109
Percentage used for electricity	13%	53%	72%	82%	86%	92%	90%	88%

Table 25 continued: Plant biomass used in the UK to generate heat and electricity: 2008 to 2013

	Thousand tonnes of oil equivalent						
	2008	2009	2010	2011	2012	2013	% change 2012/13
Total plant biomass used for heat /electricity	900	1 054	1 356	1 606	1 738	2 473	42
Of which:							
Used to generate electricity	706	826	1 086	1 317	1 463	2 134	46
Co-firing with fossil fuels	517	440	625	764	401	54	-87
Plant Biomass ^(a)	189	387	461	554	1 062	2 080	96
Used to generate heat (plant biomass only) ^(b)	194	227	270	288	275	339	23
Percentage used for electricity	78%	78%	80%	82%	84%	86%	

Source: Table 6.6 from Chapter 6 of the DECC Digest of UK Energy Statistics (DUKES)-2014

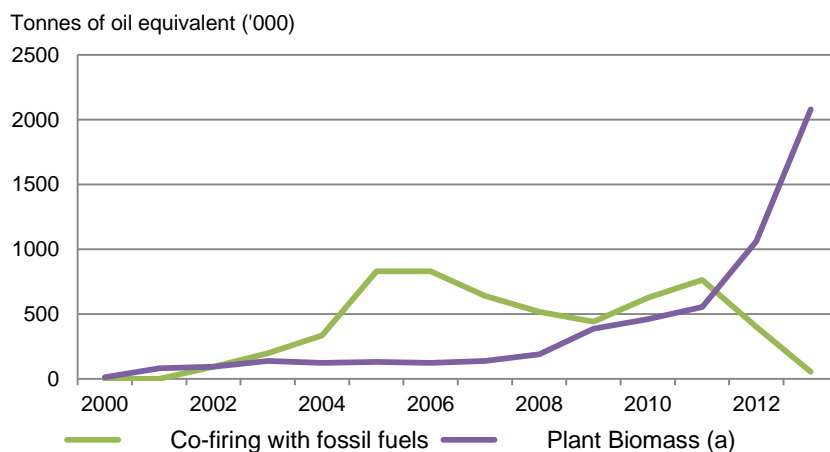
<https://www.gov.uk/government/statistics/renewable-sources-of-energy-chapter-6-digest-of-united-kingdom-energy-statistics-dukes>

a) Includes straw combustion and energy crops

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

- The data show that the largest proportion (around 80-90%) of plant biomass is used for generating electricity.
- Between 2012 and 2013 there was a 42% increase in the volume of plant biomass used to generate heat and electricity reflecting new conversions from previously coal-fired capacity to biomass.
- Figure 1 shows the volumes used for electricity over time highlighting the different patterns in plant biomass usage according to whether the material is burnt by itself or as a blend with fossil fuels.
- Usage of pure plant biomass has steadily been increasing since 2000. However usage of biomass co-fired with fossil fuels has fluctuated, peaking in the mid part of the decade and again in 2010 and 2011.

Figure 1: Volume of plant biomass used for electricity: 2000 to 2013



Source: Table 6.6 from Chapter 6 of the DECC Digest of UK Energy Statistics (DUKES) 2014

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.

3.8 UK Straw availability and usage

Table 26: Selected UK cereal areas at June each year

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

Source: June Survey of Agriculture.

Table 27: 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
Wheat	6 535	6 426	6 407	7 281	6 214	6 785	6 893	6 972	5 651
Barley	2 579	2 424	2 469	2 838	3 143	2 533	2 667	2 756	3 336
Oats	316	425	453	473	452	436	380	427	618
Total	9 430	9 275	9 329	10 591	9 809	9 754	9 940	10 154	9 604

- Table 27 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; these should provide useful comparisons to the industry information
- Normally around 60% of the straw produced can be baled and used for other purposes; the remaining stubble is incorporated back into the soil.

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		3 004
Cereal straw usage:			
Animal bedding ^(b)	5 800	56%	1 675
Animal feed ^(b)	2 000	19%	578
Mushroom industry ^(c)	40	0%	12
Carrots ^(d)	405	4%	117
Power stations ^(e)	230	2%	66
Surplus cereal straw resource available in the UK for other markets	1 925	19%	556

(a) Area of wheat, barley and oats. Implied areas are calculated as the % of cereal straw production multiplied by the 2013 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-2012-13>

- Around 10 million tonnes of cereal straw is produced in the UK each year. The two main uses of straw are livestock bedding and feed.
- Around 230 thousand tonnes of straw (2% of total straw production) was used as fuel in biomass power stations in England in 2012/13.
- 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

End usage	% of straw production
Home use bedding / feed	40%
Home use biomass	0.3%
home use for other purposes	1%
Sold / exchanged for feed / bedding	42%
Sold for biomass	5%
Sold for other purposes	11%

Source: Defra, Cereal Production Survey

- In 2014, 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 28.

3.1 Power station usage of straw

Table 30: Straw usage in English power stations 2009/10 - 2012/13^(a)

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

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 2012/13, 230 thousand tonnes were used by power stations in England. This was an increase of 7% compared to 2011/12.
- 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	Operational 2015	66
Snetterton, Norfolk	Planning application approved 2012	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.briggprep.co.uk/>

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

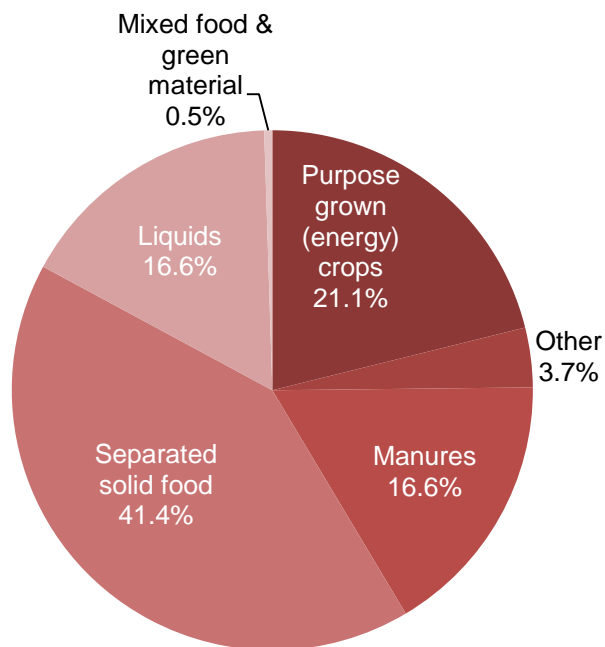
Wetwang: <http://www.eastriding.gov.uk/padocs/AUGUST2011/68D93C0E3CB211DF98B4AC53E757C93D.pdf>

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: Feedstock type as percentage of total reported feedstocks, UK 2012



(Excludes feedstocks for industrial facilities that discharge treated water to sewer)

Source: WRAP A Survey of the UK Organics Recycling Industry in 2012

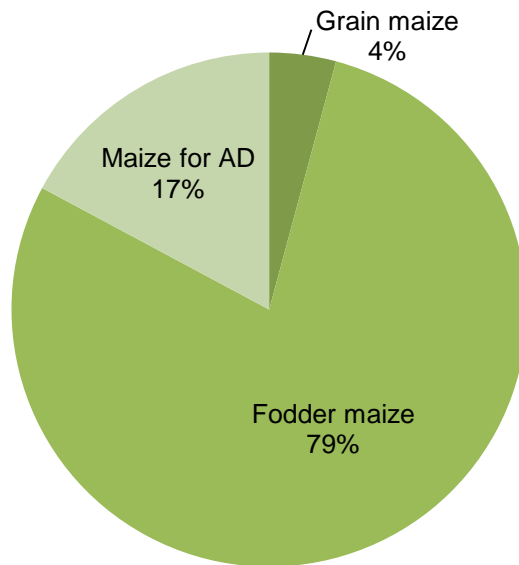
- Data from the 2012 WRAP Organics Recycling Survey⁷ (See [Annex B](#) for details) indicate that purpose grown crops accounted for 21% of total reported AD feedstocks.
- Total AD capacity in 2012 was just over 2 million tonnes; of this the capacity of on-farm AD plants was 706 thousand tonnes. Inputs were 631 thousand tonnes of which 389 thousand tonnes were supplied from purpose grown crops.
- 16 thousand tonnes of purpose grown crops were also fed into commercial plants.
- Significant variation was seen 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 and solid food.

⁷ Previous reports have covered 2009 and 2010, however the 2012 AD results are not comparable with 2010 due to methodology changes and the small number of responses in that year.

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 2014



Source: June Survey of Agriculture

- The June Survey of Agricultural and Horticulture asked farmers to specify the end purpose of their maize for the first time 2014.
- At June 2014 maize being grown for AD accounted for 17% (29,373 hectares) of the total maize area in England, which was 0.5% of the total arable area.

Annex A: Glossary of terms and conversion factors

Definition of biodiesel and bioethanol (Source: Chapter 6, paragraph 6.112 of DUKES 2014)

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. Diesel fuel currently sold at a number of outlets is a blend with 5 per cent biodiesel. 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 Notice

179E: Biofuels and other fuel substitutes, October 2009, available at:

http://customs.hmrc.gov.uk/channelsPortalWebApp/channelsPortalWebApp.portal?_nfpb=true&_pageLabel=pageVAT_ShowContent&id=HMCE_CL_000205&propertyType=document#P22_1468.

Diesel fuel currently sold at retail outlets in the UK can contain up to 7 per cent biodiesel. Petrol currently sold in 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 labelled⁸.

Conversions

- Tonnes of oil equivalent to GJ
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/337552/chapter_1.pdf

- 2004 - 2013 calorific values of fuels to convert GJ to tonnes are available at:
https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/338424/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)

Source: Department for Transport <https://www.gov.uk/government/publications/rfto-guidance>

⁸ www.gov.uk/government/uploads/system/uploads/attachment_data/file/232126/petrol-protection-extension-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 of Transport website at: <https://www.gov.uk/renewable-transport-fuels-obligation>.

Since the implementation of the Renewable Energy Directive⁹ 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>

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 production which may subsequently be exported.
- 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.

⁹ 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>

- Prior to the implementation of the Renewable Energy Directive¹⁰ (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 2013 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 of 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>

¹⁰ 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 also asked on straw production and usage for the first time. The latest results can be found at:

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/RenewableObligation/FuelledStations/ro-sustainability> (2010-11 data)

<http://www.ofgem.gov.uk/Pages/MoreInformation.aspx?docid=248&refer=Sustainability/Environment/RenewableObligation/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)

B6. WRAP Organics Recycling Survey 2012

The WRAP Organics Recycling Survey 2012¹¹ 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 Map¹² 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>

¹¹ 2012 WRAP Survey of UK Organics Recycling Industry:
<http://www.wrap.org.uk/sites/files/wrap/ASORI%202012.pdf>

¹² Available at: www.biogas-info.co.uk

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).