



Crops Grown For Bioenergy in England and the UK: 2015



About this release

This release contains information on the area of non-food crops grown in the UK including:

- Areas of oilseed rape, sugar beet and wheat used for producing biofuels and maize for use in anaerobic digestion.
- Areas of miscanthus, short rotation coppice and straw crops grown as plant biomass.

Key Messages

- 93 thousand hectares of agricultural land was used for bioenergy in the UK in 2015.
- The area of crops grown for bioenergy equated to just under 2% of all arable land in the UK in 2015.
- 53% of land used for bioenergy in 2015 was for biofuel for the UK road transport market.
- 1 million tonnes of UK crops were produced for the UK road transport market

Figures relating to biofuel used for road transport in 2015/16 (year runs mid-April to mid-April) are provisional based on data currently available. These shows that, of the total volume of renewable fuel supplied in 2015/16, 99% (1,546 million litres) has so far been demonstrated to meet the sustainability requirements (see [Annex B](#) for more details).

A dataset covering longer time series for selected data tables has been published alongside this statistics release and is available [here](#).

The next update to this statistical release is anticipated in Autumn 2017 and will be published [here](#).

Revisions

Section 1: volumes of biofuels supplied to the UK road transport market in 2014/15 have been revised to reflect the final estimates. There have been no other revisions to previously published estimates.

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Use of the 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. From 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/statistics/farming-statistics-provisional-crop-areas-and-livestock-populations-at-june-2016-united-kingdom>

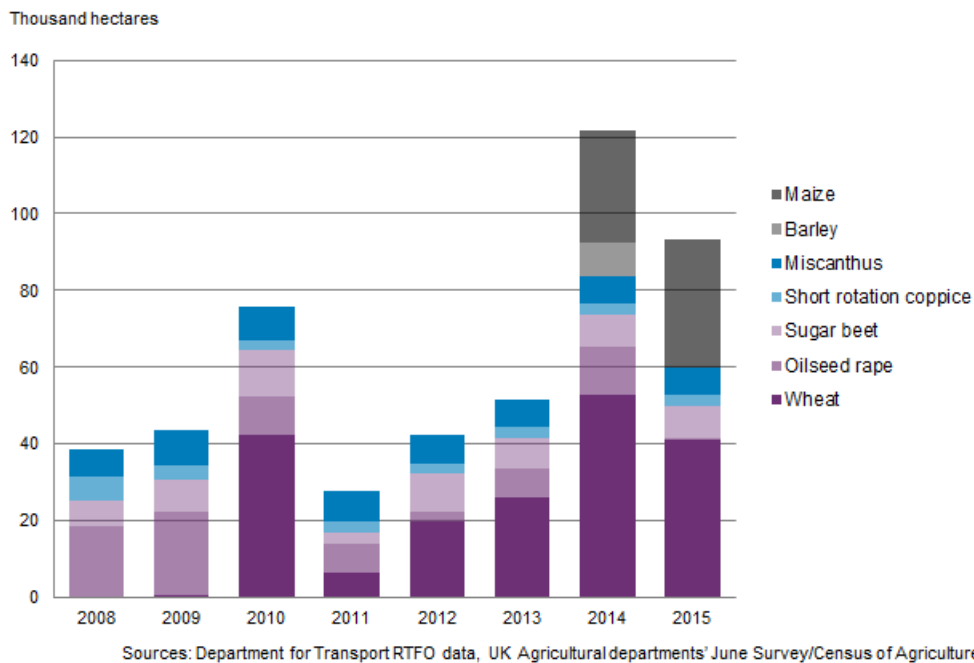
- *Renewable Transport Fuels Obligation data* (collected by the Department for Transport). This data source provides information on the volume of biofuel supplied to the UK road transport market. It includes a breakdown of information by fuel type (e.g. biodiesel, bioethanol) and by feedstock used (e.g. 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 (the reporting year runs mid-April to mid-April). 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 Renewable Energy STATistics (RESTATS) Questionnaire (see below) help give an indication of the fuller picture.

- *Renewable Energy STATistics (RESTATS) Questionnaire* (collected by the Department for Business, Energy and Industrial Strategy). The purpose of this survey is to determine UK production of biofuels. Since 2012, the survey has also asked questions on the type and origin of feedstocks for the first time. This provides 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. With the data reported under the RTFO (described above) it helps build a more complete overall picture.

Overview of agricultural area used for bioenergy crops

Figure 1: Total area of crops grown for bioenergy, 2008 - 2015



(a) Data for maize only available from 2014.

- 93 thousand hectares of agricultural land was used for bioenergy crops in the UK in 2015 comprising: 41 of wheat, 34 of maize, 9 of sugar beet, 7 of miscanthus, 3 of short rotation coppice and 0.3 of oilseed rape.
- Arable land³ used for bioenergy crops in the UK fell by 23% in 2015 and accounted for 1.6% of the total arable area.
- Just over half (53%) the land used for bioenergy in 2015 was for biofuel (biodiesel and bioethanol) crops for the UK road transport market.
- In terms of area, 10% of sugar beet, 2% of wheat and less than 1% of oilseed rape was used for biofuel production in the UK in 2015.

A detailed breakdown of all figures for 2008 to 2015 can be found in Table A of the [crops for bioenergy dataset](#).

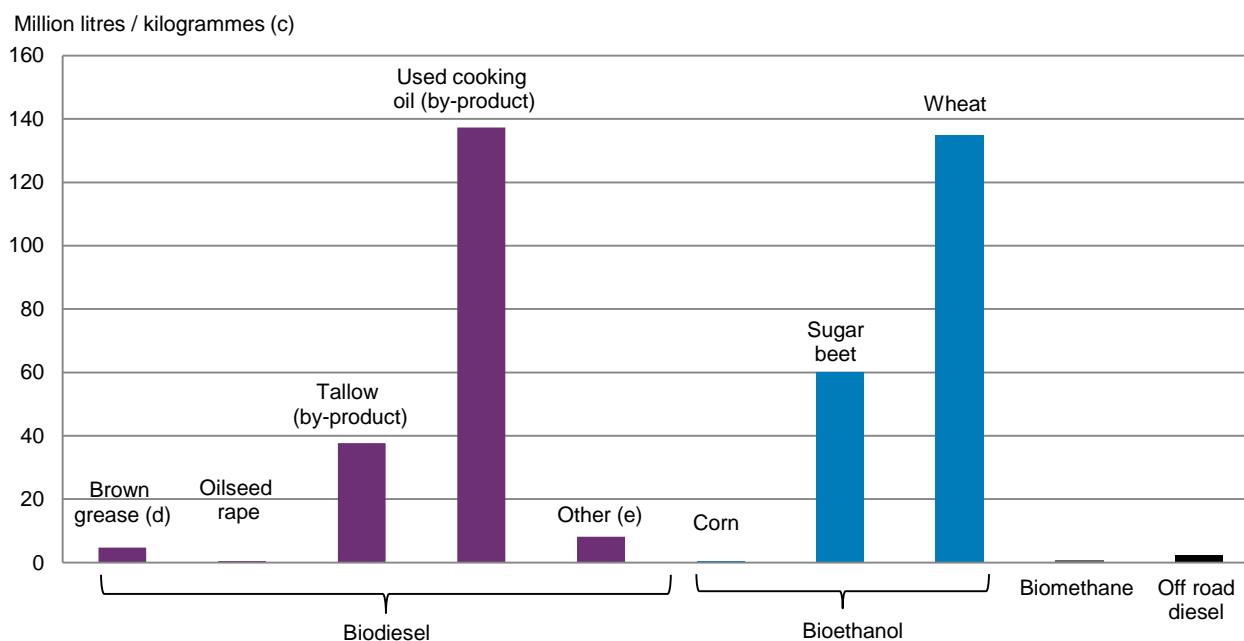
³ Arable area is defined as the area of arable crops, uncropped arable land and temporary grassland.

1. Biofuels

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

Figure 2 summarises UK sourced biofuels reported under the Renewable Transport Fuels Obligation (i.e. the biofuels used in the UK that are made from UK feedstocks). Crops and by-products have been included to show differing proportions of feedstocks.

Figure 2: Volume of UK sourced biofuels supplied to the UK road transport market by crop type and waste / residue, 2015/16^{(a)(b)}



Sources: Department for Transport RTFO data

(a) 2015/16 figures are as of 3rd November 2016 and are subject to revision.

(b) Year relates to 15th April 2015 - 14th April 2016.

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

(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.

- The total volume of UK sourced biofuels used in the UK in 2015/16 was 386.3 million litres, a decrease of 22% compared to 2014/15.
- The volume of UK sourced biodiesel and bioethanol for UK road transport both decreased by a similar percentage in 2015/16; biodiesel fell by 22% to 188.3 million litres and bioethanol by 23% to 195 million litres.

A detailed breakdown from 2008/09 can be found in Table B of the [crops for bioenergy dataset](#).

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

Tables 1 to 5 focus on the arable crops used as feedstocks and translate the biofuel volumes reported under the Renewable Transport Fuels Obligation (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 1: Conversion factors, litres to tonne of crop

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

Source: Department for Transport <https://www.gov.uk/government/publications/rtfo-guidance> and [The National Non-Food Crops Centre](#) .

Table 2: Total UK crop areas used for biofuels (biodiesel and bioethanol) supplied to the UK road transport market, 2008/09 - 2015/16

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	271.3	1 226	82.5 (1.3%)
Year 8: 15 April 2015 - 14 April 2016 (prov) ^(c)	213.3	1 020	49.9 (0.8%)

(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. Data from the 2008 June Survey of Agriculture have been used in conjunction with RTFO year 1 (2008-2009). Subsequent years follow the same pattern.

(c) 2015/16 figures (Year 8) are as of 3rd November 2016 and are not final. The total volume includes bioethanol produced from a small amount UK grown corn (see Figure 2).

- Just over 1 million tonnes of UK grown crops were used for biofuel production for the road transport market in 2015/16, a decrease of 17% compared to 2014/15 usage.
- An estimated 50 thousand hectares of UK crops were used for biofuels supplied to the UK road transport market which equates to 0.8% of the total arable area of the UK.

Table 3: UK sugar beet areas used for bioethanol supplied to the UK road transport market 2008/9 - 2015/16

Sugar beet (RTFO Year)	Volume of bioethanol (million litres) ^(a)	Tonnage of crop implied ('000 tonnes) ^(b)	sugar beet yield (t/ha) ^(c)	Area implied '000 ha and % of UK total sugar beet area ^(d)
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	67.9	672	80	8.4 (7%)
Year 8: 15 April 2015 - 14 April 2016 ^(g)	60.0	594	69	8.6 (8%)

Table 4: UK wheat areas used to produce bioethanol supplied to the UK road transport market 2008/9 - 2015/16

Wheat (RTFO Year)	Volume of bioethanol (million litres) ^(e)	Tonnage of crop implied ('000 tonnes) ^(b)	wheat yield (t/ha) ^(f)	Area implied '000 ha and % of UK total wheat area ^(d)
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	166.1	452	8.6	52.7 (3%)
Year 8: 15 April 2015 - 14 April 2016 ^(g)	134.9	368	9.0	41.0 (2%)

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

(b) Based on conversions from the Department for Transport. Details provided in Table 1.

(c) Source: British Sugar figures supplied to Defra for the "Agriculture in the UK" annual publication.

<https://www.gov.uk/government/collections/agriculture-in-the-united-kingdom> UK yield for 2008 has been used in conjunction with RTFO year 1 (2008-2009). Subsequent years follow the same pattern.

(d) Source: Defra, June Survey of Agriculture. Data from the 2008 survey have been used in conjunction with RTFO year 1 (2008-2009). Subsequent years follow the same pattern.

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

(f) Source: Defra annual Cereal and Oilseed Rape Production Survey. Data from the 2008 survey have been used in conjunctions with RTFO year 1 (2008-2009). Subsequent years follow the same pattern.

(g) 2015/16 figures (Year 8) are as of 3rd November 2016 and are not final.

- Just over 8 and a half thousand hectares of sugar beet were used in the production of bioethanol for the road transport market in 2015/16, a 2% increase on 2014/15. More details of sugar beet use for bioenergy can be found at [Annex C](#)
- An estimated 41 thousand hectares of wheat was used for bioethanol in 2015/16. This was a reduction in area of 22% on 2014/15, reflecting the temporary closure of one of the two UK plants during this period.

Table 5: UK oilseed rape areas used for biodiesel supplied to the UK road transport market, 2008/09 - 2015/16

Oilseed Rape (RTFO Year)	Volume of biodiesel (million litres)			Tonnage of crop implied ('000 tonnes) ^(c)	OSR yield (t/ha) ^(d)	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	19.3	12.7	6.6	45	3.6	12.5 (2%)
Year 8: 15 April 2015 - 16 April 2015 ^(f)	0.5	0.0	0.5	1	3.9	0.3 (0.04%)

(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' as the land use would have been some type of crop land.

(c) Based on conversions from the Department for Transport. Details provided in Table 1.

(d) Source: Defra annual Cereal and Oilseed Rape Production Survey. Data from the 2008 survey have been used in conjunctions with RTFO year 1 (2008-2009). Subsequent years follow the same pattern.

(e) Source: Defra June Survey of Agriculture. Data from the 2008 survey have been used in conjunction with RTFO year 1 (2008-2009). Subsequent years follow the same pattern.

(f) 2015/16 figures (Year 8) are as of 3rd November 2016 and are not final.

- An estimated 282 hectares of oilseed rape was used for biodiesel in 2015/16. It is likely that this was exported for processing and then re-imported for use as results from the Renewable Energy STATistics (RESTATS) Questionnaire (see [Section 1.5](#)) suggest no oilseed rape was processed in the UK in 2015.
- This significant reduction on the 2014/15 area reflects a longer term shift in feedstock type with increasing use of wastes and less crop biodiesel compared to the early years of the RTFO.

1.3 Biofuels from crops supplied to the UK for the road transport market 2015/16

- In 2015/16, the majority of crop derived biofuels for road transport originated from crops grown outside the UK. An estimated 30% originated from crops grown in the UK, this was little change on the 2014/15 percentage. See Figure 1 for areas by type of crop.

Table 6: RTFO volume of bioethanol supplied in the UK by crop feedstock country of origin 2015/16

Feedstock	Country of origin	Volume of biofuel supplied in UK (million litres)	
Bioethanol	Barley	Germany	0.0
		Austria	0.3
		Belgium	0.1
		Bulgaria	0.4
		Czech Republic	3.1
		France	35.0
		Germany	0.25
		Hungary	20.4
		Poland	5.6
	Corn	Romania	19.0
		Serbia	3.9
		Slovakia	5.8
		Spain	42.1
		Tanzania	0.0
		United Kingdom	0.03
		Ukraine	48.51
		United States	8.9
	Molasses	Germany	1.1
	Rye	Germany	1.4
		Belgium	0.0
		Czech Republic	1.3
	Sugar beet	France	107.5
		Germany	10.4
		United Kingdom	60.0
		Bolivia	5.4
		Brazil	23.6
		Costa Rica	12.3
	Sugar cane	Guatemala	7.6
		Nicaragua	0.0
		Peru	1.2
		Sierra Leone	0.9
		Germany	1.2
Triticale	Poland	0.4	
	Belgium	0.5	
	Czech Republic	9.9	
	Ecuador	0.1	
	France	55.4	
Wheat	Germany	8.3	
	Hungary	0.1	
	Poland	0.0	
	Slovakia	0.2	
	United Kingdom	134.9	

Table 7: RTFO volume of biodiesel supplied in the UK by crop feedstock and country of origin 2015/16

	Feedstock	Country of origin	Volume of biofuel supplied in UK (million litres)
Biodiesel	Oilseed rape	Australia	1.1
		Belgium	0.1
		France	0.1
		Germany	3.4
		Lithuania	0.0
		Ukraine	0.5
		United Kingdom	0.5
	Palm	Indonesia	0.02
	Soy	Argentina	0.1
		Brazil	0.5
Total biodiesel and bioethanol			637.2
<i>% from UK feedstocks</i>			<i>30%</i>

1.4 Comparison of biofuels to all fuels used for road transport

Tables 8 and 9 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 8: RTFO Year 7 (2014/15) 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 2014/15	Total volume biofuels supplied to UK 2014/15 ^(b)	Total volume of road transport fossil fuels supplied to UK 2014/15		
Biodiesel of which:	243	837	27 172	29%	3%
Brown grease ^(c)	2				
Oilseed rape	19				
Tallow (by-product)	62				
Used cooking oil (by-product)	159				
Other ^(d)	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%^(e)
Annual target^(f)					4.75%

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

(e) 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 feedstocks only have to supply half the volume to meet their obligation.

(f) 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.

- 1,671 million litres of biofuel fuel were supplied to the UK in 2014/15. The obligation on biofuel supplied for 2014/15 was 2,503 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 shortfall⁴.
- All suppliers met their obligations in full in 2014/15 through the redemption of RTFCs⁵.

⁴ Further details can be found at: <https://www.gov.uk/renewable-transport-fuels-obligation>

⁵ https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/497775/rtfo-year-7-report-6.pdf

Table 9: RTFO Year 8 (2015/16) provisional figures^(a) for biofuel from UK feedstocks

Fuel type	Million litres or kg ^(b)			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 2015/16	Total volume biofuels supplied to UK 2015/16 ^(c)	Total volume of road transport fossil fuels supplied to UK 2015/16		
Biodiesel of which:	188	733	28 413	26%	3%
Brown grease ^(d)	5				
Oilseed rape	0.5				
Tallow (by-product)	38				
Used cooking oil (by-product)	137				
Other ^(e)	8				
Bioethanol of which:	195	788	16 435	25%	5%
Corn	0.03				
Sugar beet	60				
Wheat	135				
Biomethane	1	1		100%	
Biomethanol	0	31		0%	
HVO (renewable portion)	0	8		0%	
Off road diesel	2	3		79%	
Total	386	1 564	50 103	25%	3.0%^(f)
Annual target^(g)					4.75%

(a) 2015/16 figures (Year 8) are as of 3rd November 2016 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 feedstocks 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 use.

Data for RTFO years 1 to 6 can be found in previous releases of these statistics at:

<https://www.gov.uk/government/collections/non-food-crops>

1.5 Renewable Energy STATistics (RESTATS) Questionnaire

The Department for Business, Energy and Industrial Strategy (BEIS, formally 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, from 2012, 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 10 compares total UK biofuel production to total biofuel supplied to the UK road transport market while Tables 11 and 12 give an estimate of the proportion of UK biofuel production from crop feedstocks and also the proportion of biofuel supplied by end use. The survey is based on calendar years.

Table 10: UK biofuel production and biofuel supply to UK road transport market, 2010 - 2015

	Million litres			
	2012	2013	2014	2015
Biodiesel				
Total UK production	280	300	160	167
Total biodiesel supplied to UK road transport market	634	766	955	674
Bioethanol				
Total UK production	154	524	516	333
Total bioethanol supplied to UK road transport market	775	820	812	797

Source: Renewable Energy Survey / Digest of UK Energy Statistics

- UK production of biodiesel increased by 4% in 2015 while for bioethanol there was a decrease of 35% over the same period. Data from 2010 are available in Table C of the [crops for bioenergy dataset](#).

Table 11: Renewable Energy Survey UK biodiesel production and supply (from UK production), 2012 - 2015

	Biodiesel			
	2012	2013	2014	2015
% of UK biodiesel production derived from crop feedstocks	5%	44%	0%	0%
% of those crop feedstocks that are UK produced	98%	100%	0%	0%
% of biodiesel supply to:				
UK road transport	99%	96%	73%	74%
UK Non-Road Transport	0%	0%	1%	2%
UK Heat and Power	1%	1%	1%	2%
Exported ^(a)	na	3%	3%	22%
Other	0%	0%	22%	0%

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

Table 12: Renewable Energy Survey, UK bioethanol production and supply (from UK production), 2012 - 2015

	Bioethanol			
	2012	2013	2014	2015
% of UK bioethanol production derived from crop feedstocks	100%	100%	100%	100%
% of those crop feedstocks that are UK produced	96%	91%	85%	97%
% of bioethanol supply to:				
UK road transport	61%	63%	50%	95%
UK Non-Road Transport	1%	6%	0%	5%
UK Heat and Power	0%	0%	0%	0%
Exported ^(a)	na	31%	50%	0%
Other	38%	0%	0%	0%

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

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 units or heating systems.

2.1 Miscanthus areas

Table 13: Total planted area of miscanthus in England

	Hectares							
	2008	2009	2010	2011	2012	2013	2014	2015
England	7 465	9 213	8 657	8 075	7 517	7 078	7 012	6 905
<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>	<i>+/- 555</i>	<i>+/- 514</i>
Number of growers	335	394	404	398	422	393	569	409

Source: Defra June Survey of Agriculture and Horticulture. Defra analysis to produce numbers of growers.

A region breakdown for 2010 and 2013 is available in the 2015 crops for bio energy statistical release at: <https://www.gov.uk/government/statistics/area-of-crops-grown-for-bioenergy-in-england-and-the-uk-2008-2014>

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 Agriculture⁶.
- Miscanthus is grown on around 0.1% of the total arable area in England.
- Subsidy schemes provide a secondary source of area statistics (Table 14). 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). The current Energy Crops scheme closed in 2013 although planting for the scheme could be undertaken in 2013, 2014 and 2015. More background can be found at [Annex B](#).
- The total area of new plantings claimed under subsidies since 2000 is 10,051 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 under 7 thousand hectares of miscanthus in 2015.

⁶ 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.

Table 14: Area of Miscanthus new plantings under the Energy Crops Scheme: England

Region	ECS2: 2008-2015 area ^{(b)(c)}								Hectares	
	2008	2009	2010	2011	2012	2013	2014	2015	ECS2: 2008-2015 total area ^(c)	Total area claimed under ECS 2000 ^(a) - 2015
North East	0	0	0	0	0	0	0	0	0	0
North West	0	0	0	14	14	61	35	0	124	187
Yorkshire & The Humber	32	43	83	132	102	98	49	39	578	2 421
East Midlands	45	100	91	119	242	174	23	56	850	2 740
West Midlands	24	90	81	180	376	306	8	8	1 072	1 931
East of England	0	0	34	83	67	71	41	15	296	677
South East	9	36	42	21	42	33	51	0	235	539
South West	22	211	114	40	21	25	53	20	506	1 542
England total	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 December 2015.

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

2.2 Miscanthus yields / production

Although much research has been done on miscanthus yields, 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 15: Miscanthus production based on upper and lower yield estimates^(a)

	Thousand oven dried tonnes							
	2008	2009	2010	2011	2012	2013	2014	2015
Lower estimate	75	92	87	81	75	71	70	69
Upper estimate	112	138	130	121	113	106	105	104

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.

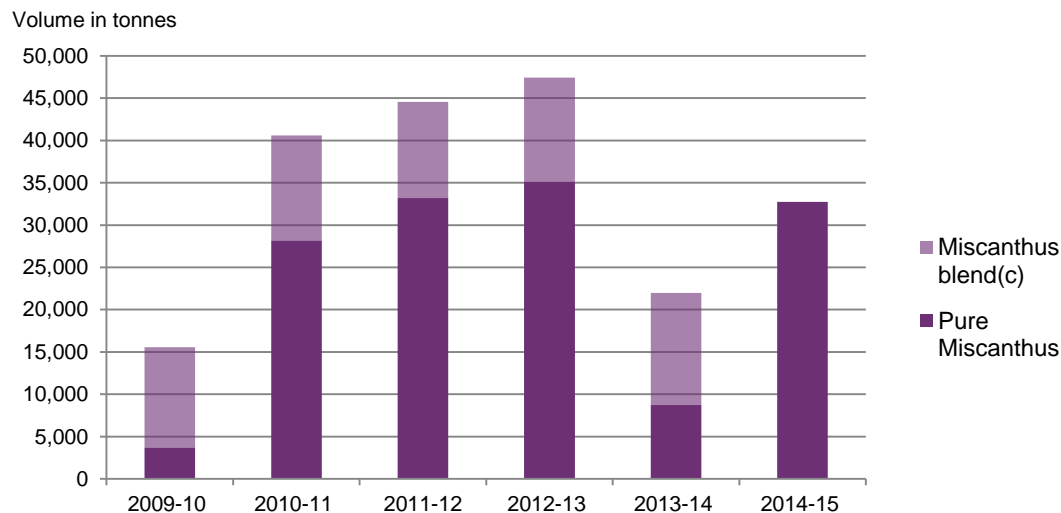
(a) Estimates based on areas from the June Survey of Agriculture and Horticulture and yields of 10 to 15 oven dried tonnes per hectare

- 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

Usage data are collated by Ofgem as part of sustainability requirements under the Renewables Obligation. There are other outlets for using miscanthus including horse and livestock bedding, in small scale combined heat and power 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.

Figure 3: Miscanthus usage in UK power stations^{(a)(b)}



Source: Ofgem Renewables Obligations dataset

(a) Tonnes 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.

See [Annex B](#) for details of the Ofgem Renewables Obligations dataset

A detailed breakdown of all figures for 2009/10 to 2014/15 can be found in Table D of the [crops for bioenergy dataset](#).

- Approximately 33 thousand tonnes of miscanthus were used in UK power stations for electricity in 2014/15 which was just under half of all miscanthus produced in England in 2015, based on low end assumptions of yields.
- The 2014/15 volume was an increase of nearly 50% on the previous year. 2014/15 was the first year when solid biomass and biogas stations with a total installed capacity (TIC) of 1MW or greater had to submit a sustainability audit which may have influenced this figure⁷.
- The decrease in usage in 2013/14 reflects the Renewables Obligation Amendment Order which came into force in April 2013 and introduced a number of changes that reduced the incentive for stations to use energy crops⁸. The significant increase in usage in 2010/11 was due to more use at Ely power station (while volumes of straw used were reduced).

⁷ Section 4, Renewables Obligation Annual Report 2014/15 <https://www.ofgem.gov.uk/publications-and-updates/biomass-sustainability-dataset-2014-15>

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 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 16: Total planted area of Short Rotation Coppice grown in England

	Hectares							
	2008	2009	2010	2011	2012	2013	2014	2015
England total	6 216	3 721	2 591	2 720	2 551	2 650	2 849	2885
95% confidence interval	+/- 2 839	+/- 1 349	+/- 416	+/- 768	+/- 702	+/- 218	+/- 503	+/- 656
Number of growers	373	381	251	228	186	230	182	361

Source: Defra June Survey of Agriculture and Horticulture Defra analysis to produce regional figures and numbers of growers.

A region breakdown for 2010 and 2013 is available in the 2015 crops for bio energy statistical release at:

<https://www.gov.uk/government/statistics/area-of-crops-grown-for-bioenergy-in-england-and-the-uk-2008-2014>

- 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 (Table 17). The current Energy Crops scheme closed in 2013 although planting for the scheme could be undertaken in 2013, 2014 and 2015. More background can be found at [Annex B](#).
- Comparing the total area of new plantings claimed under subsidies since 2000 (2,489 hectares) to the 2015 Defra June Survey area (2,885 hectares) suggests that the vast majority of SRC is grown within the subsidy payment scheme.

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

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

(a) 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 December 2015.

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

(c) 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>.

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 18: Short Rotation Coppice production based on upper and lower yield estimates^(a)

	Thousand oven dried tonnes							
	2008	2009	2010	2011	2012	2013	2014	2015
Lower estimate	37	22	16	16	15	16	17	17
Upper estimate	75	45	31	33	31	32	34	35

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.

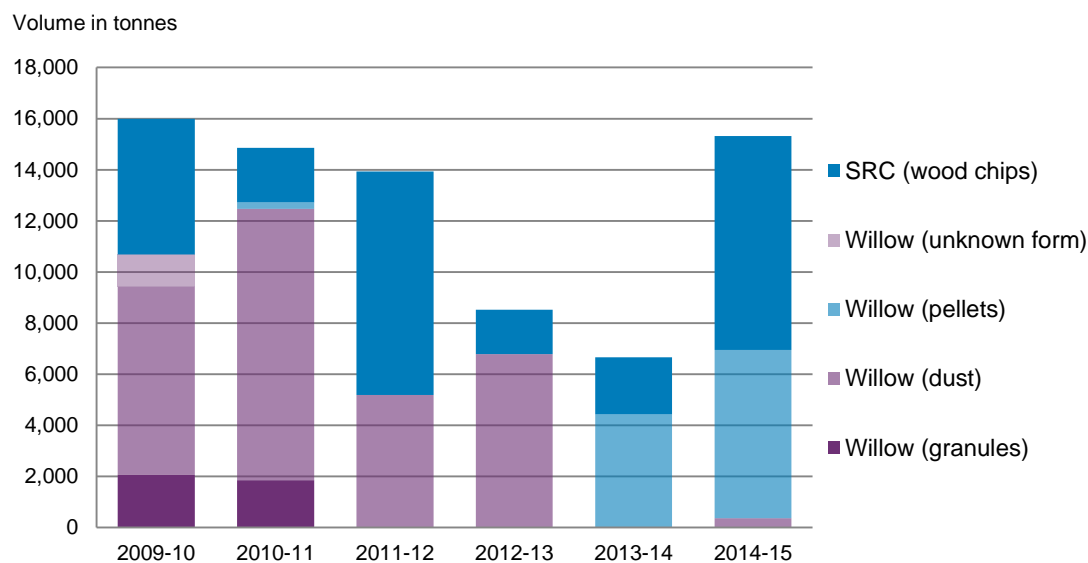
- Industry experts at the National Non Food Crops Centre (NNFCC) estimate that SRC yields vary between 25 to 35 oven dried tonnes/ha, equating to an annual yield average of 9.4 odt/ha/yr (taking the average 3 yearly harvest period into account).
- Natural England and the Forestry Commission suggest yields 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 18 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 2015, 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.

- Approximately 15 thousand tonnes of SRC were used in UK power stations for electricity in 2014/15, more than double the volume used in the previous year (Figure 3). 2014/15 was the first year when solid biomass and biogas stations with a total installed capacity (TIC) of 1MW or greater had to submit a sustainability audit which may have influenced the 2014/15 figure⁹.
- The decrease between 2012/13 and 2013/14 reflects the Renewables Obligation Amendment Order which came into force in April 2013 and introduced a number of changes that reduced the incentive for stations to use energy crops¹⁰.
- The volume of SRC used in UK power stations was around 90% of all the SRC produced in England in 2015, based on low end assumptions of yields.

Figure 4: Short Rotation Coppice usage in UK power stations^(a)



Source: Ofgem Renewables Obligations dataset

(a) Tonnes 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.

A detailed breakdown of all figures for 2009/10 to 2014/15 can be found in Table E of the [crops for bioenergy dataset](#).

⁹ Section 4, Renewables Obligation Annual Report 2014/15 <https://www.ofgem.gov.uk/publications-and-updates/biomass-sustainability-dataset-2014-15>

¹⁰ 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 the Department for Business, Energy and Industrial Strategy (BEIS, formally 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 19: Trends in plant biomass used in the UK to generate heat and electricity: 2011 to 2015

	Thousand tonnes of oil equivalent					% change
	2011	2012	2013	2014	2015	2014/15
Total plant biomass used for heat /electricity	1 607	1 739	2 404	3 311	4 245	28
Of which:						
Used to generate electricity	1 317	1 463	2 063	2 938	3 885	32
Co-firing with fossil fuels	764	401	54	25	38	50
Plant Biomass ^(a)	554	1 062	2 009	2 913	3 848	32
Used to generate heat (plant biomass only) ^(b)	290	277	346	379	359	-5
Percentage used for electricity	82%	84%	86%	89%	92%	

Source: Table 6.6 from Chapter 6 of the DECC Digest of UK Energy Statistics (DUKES) 2016

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

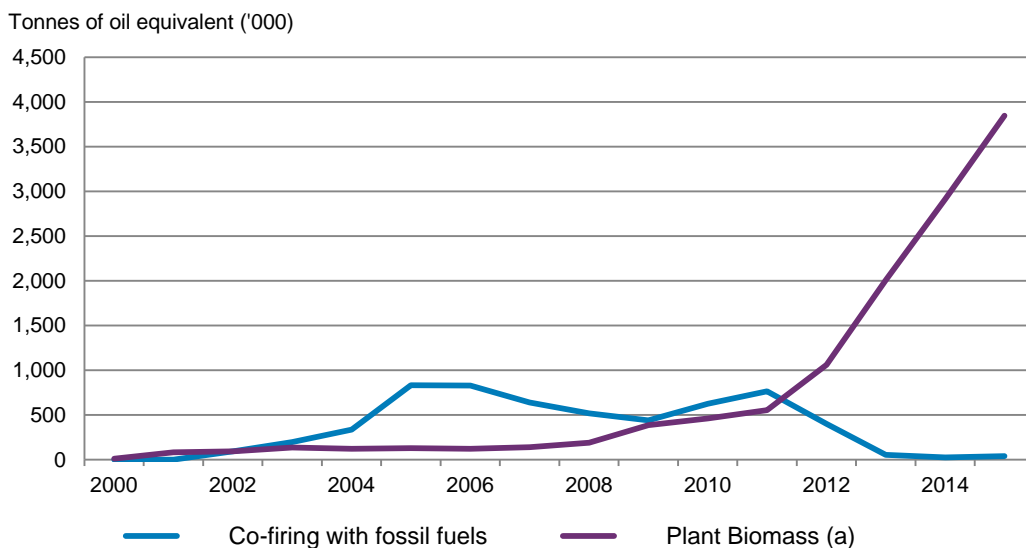
(a) Includes straw combustion and energy crops.

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

For a time series from 2009 see Table F in the [crops for bioenergy dataset](#).

- Around 80-90% of plant biomass is used for generating electricity.
- There was a 28% increase in the volume of plant biomass used to generate electricity in 2015, reflecting continued conversions from previously coal-fired capacity to biomass, Figure 5.

Figure 5: Volume of plant biomass used for electricity: 2000 to 2015



Source: Digest of UK Energy Statistics

(a) Includes straw combustion and energy crops

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 units.

3.1 UK Straw availability and usage

Table 20: Selected UK cereal areas at June each year

	Thousand hectares							
	2008	2009	2010	2011	2012	2013	2014	2015
Wheat	2 080	1 775	1 939	1 969	1 992	1 615	1 936	1 832
Barley	1 032	1 143	921	970	1 002	1 213	1 080	1 101
Oats	135	129	124	109	122	177	137	131
Total	3 247	3 047	2 984	3 048	3 116	3 004	3 153	3 064

Source: June Survey of Agriculture.

Table 21: UK estimates of cereal straw production based on survey areas and typical straw yields

	Thousand tonnes							
	2008	2009	2010	2011	2012	2013	2014	2015
Wheat	7 281	6 214	6 785	6 893	6 972	5 651	6 775	6 413
Barley	2 838	3 143	2 533	2 667	2 756	3 336	2 970	3 028
Oats	473	452	436	380	427	618	480	459
Total	10 591	9 809	9 754	9 940	10 154	9 604	10 225	9 900

- Table 20 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.

A longer time series for cereal areas and estimated yields can be found in the [crops for bioenergy dataset](#), Tables G and H.

Since 2014, Defra's Cereal and Oilseed Production Survey, which covers England, has included questions on straw yield. The results are shown in Table 22 and provide a useful comparison to the UK level industry information in Table 23.

Table 22: Estimates of cereal straw production, England

		2014	2015	2016
Wheat	Area (thousand hectares)	866	724	751
	Production (thousand tonnes)	3,527	3,021	3118
	Yield (tonnes per hectare)	4.1	4.2	4.2
Barley	Area (thousand hectares)	532	585	566
	Production (thousand tonnes)	2,037	2,347	2115
	Yield (tonnes per hectare)	3.8	4.0	3.7
Oats	Area (thousand hectares)	71	50	55
	Production (thousand tonnes)	270	196	240
	Yield (tonnes per hectare)	3.8	3.9	4.4
Oilseed rape	Area (thousand hectares)	48	37	
	Production (thousand tonnes)	119	115	106
	Yield (tonnes per hectare)	2.5	3.1	2.7

Source: Defra Cereal & Oilseed Production Survey

Table 23: Estimates of cereal straw supply and demand in the UK, 2015

UK Supply/Demand	Thousand tonnes	% of cereal straw production	Implied cereal area ('000 ha) ^(a)
Cereal straw availability ^(b)	10 400		3 064
Cereal straw usage:			
Animal bedding ^(b)	5 800	56%	1 709
Animal feed ^(b)	2 000	19%	589
Mushroom industry ^(c)	40	0%	12
Carrots ^(d)	405	4%	119
Power stations ^(e)	404	4%	119
Surplus cereal straw resource available in the UK for other markets	1 751	17%	516

(a) Area of wheat, barley and oats. Implied areas are calculated as the % of cereal straw production multiplied by the 2015 cereal area.

(b) Tonnes 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) Tonnes 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) Tonnes sourced from Ofgem: <https://www.ofgem.gov.uk/publications-and-updates/biomass-sustainability-dataset-2014-15>

- It is estimated that 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; the remaining stubble is incorporated back into the soil. The two main uses of straw are livestock bedding and feed.
- Around 404 thousand tonnes of straw (4% of total straw production) was used as fuel in biomass power stations in England in 2014/15. 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 balance¹¹.

¹¹ 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 24: End use of cereal straw England, 2014 - 2016

End usage ^(a)	% of straw production		
	2014	2015	2016
Home use bedding / feed	40%	51%	37%
Home use biomass	0.3%	0.3%	1%
Home use for other purposes	1%	0.5%	1%
Sold / exchanged for feed / bedding	42%	36%	41%
Sold for biomass	5%	3%	5%
Sold for other purposes	11%	9%	15%

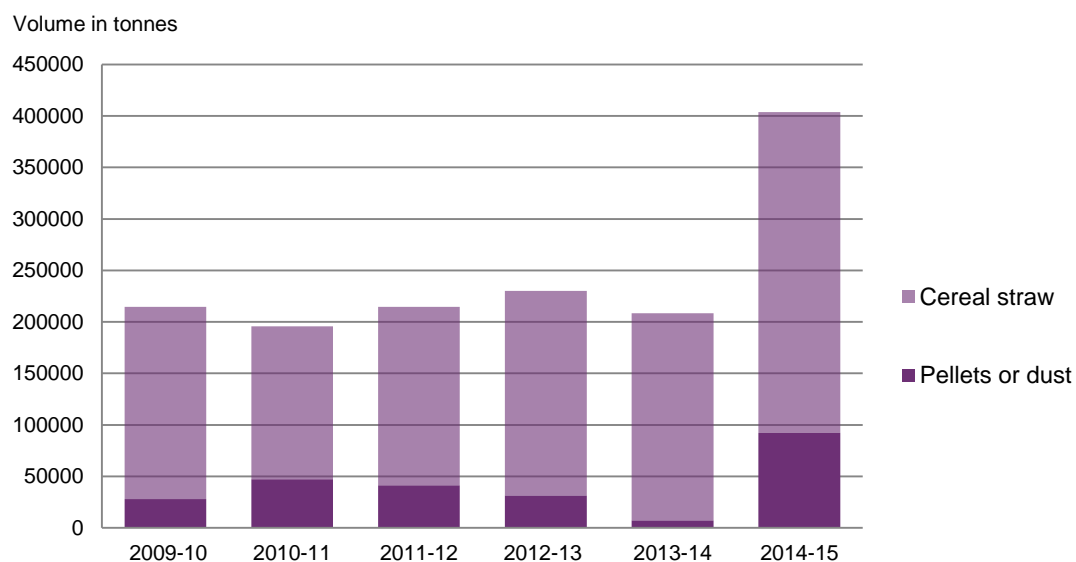
Source: Defra Cereal and Oilseed Production Survey

(a) End usage includes a small number of holdings with Rye straw tonnages

- From 2014 Defra’s Cereal and Oilseed Production Survey has included questions on the end use of straw. Table 24 shows the proportion of straw by end use. Whilst these figures cover England only they broadly in line with the UK estimates in Table 23.

3.2 Power station usage of straw

Figure 6: Straw usage in UK power stations^(a)



Source: Ofgem Renewables Obligations dataset

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

For more details of the Ofgem Annual Sustainability dataset and report see [Annex B](#).

- Data collated by Ofgem as part of sustainability requirements in the Renewables Obligation indicate that in 2014/15, 404 thousand tonnes were used by power stations (these were all in England). This was almost double the usage in 2013/14 and was influenced by a number of factors including: new power plants, conversion of previously coal-fired capacity to biomass and the new requirement that solid biomass and biogas stations with a total installed capacity (TIC) of 1MW or greater had to submit a sustainability audit¹²

¹² Section 4, Renewables Obligation Annual Report 2014/15 <https://www.ofgem.gov.uk/publications-and-updates/biomass-sustainability-dataset-2014-15>

- A detailed breakdown of all figures for 2009/10 to 2014/15 can be found in Table I of the [crops for bioenergy dataset](#).
- There are proposals for further straw burning power stations in England which are either the planning state or already have planning permission. Table 25 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 25: Potential straw usage for proposed biomass power stations

Power station name	When operational (if known)	Planned straw consumption (thousand tonnes)
Brigg, East Yorkshire	Operational 2016	240
Generation Park Norwich	Operational 2017	150
Snetterton, Norfolk	Operational 2017	250
Wetwang, Yorkshire	Outline planning granted 2013	78
Total		718

Sources:

Brigg straw power station <http://www.briggprep.co.uk/>

Generation Park Norwich <http://www.generationparknorwich.com/fags.php>

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>

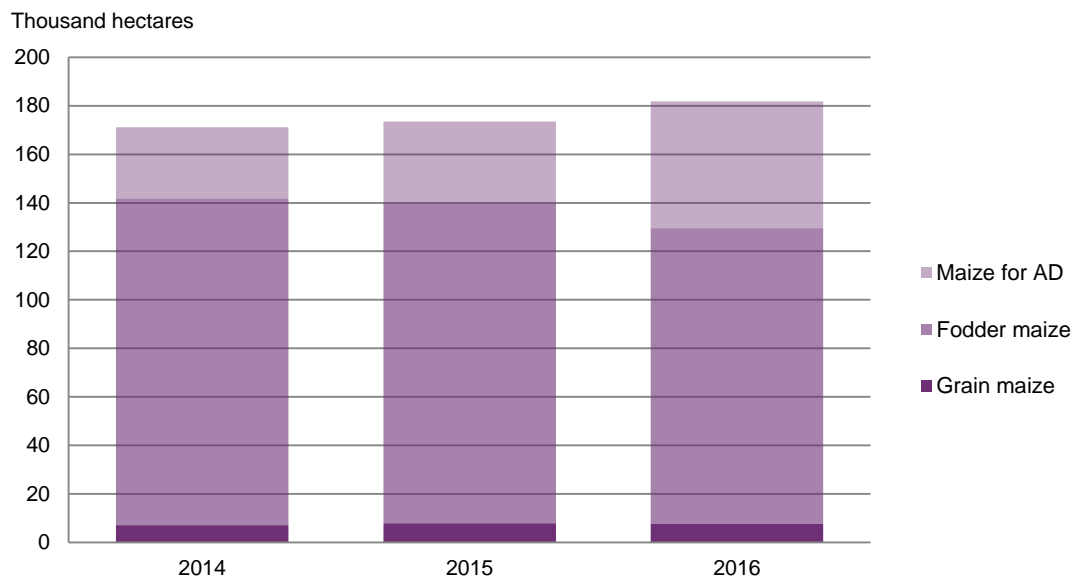
4. Anaerobic digestion

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 micro-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 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 7: Maize by intended usage, England



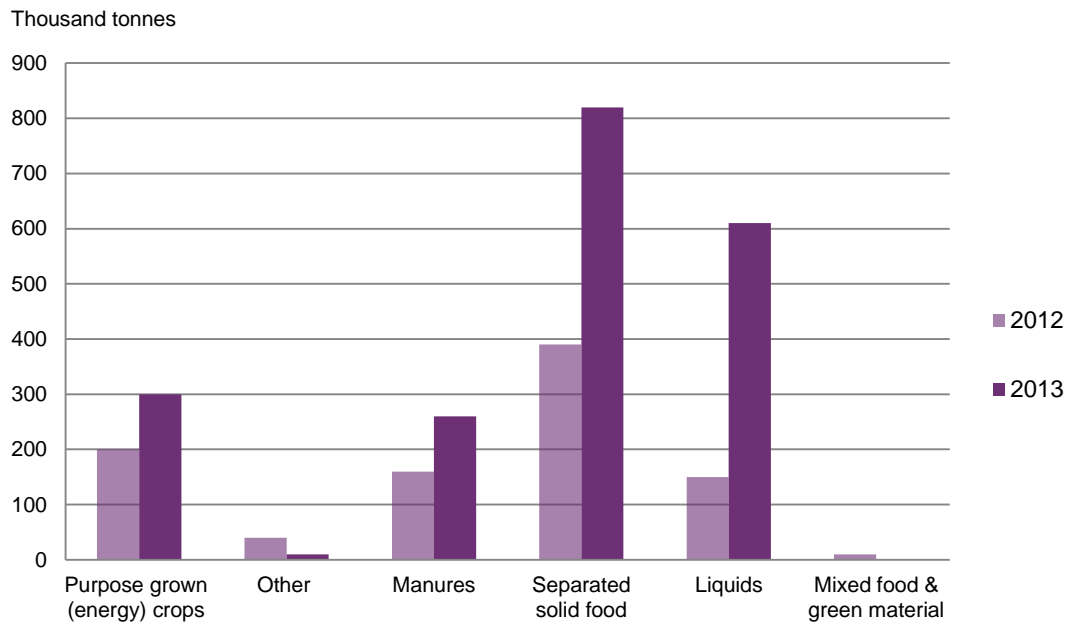
Source: June Survey of Agriculture

- The June Survey of Agricultural and Horticulture asked farmers in England to specify the end purpose of their maize for the first time in 2014.
- At June 2016 the area of maize being grown for AD was 52,280 hectares. This was an increase of 55% on 2015 and equates to 29% of the total maize area in 2016 and 1% of the total arable area.

4.2 Use of purpose grown crops as feedstocks for AD

Latest data available on crops grown crops for AD feedstocks are for 2013.

Figure 8: 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 estimate¹³ 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.

¹³ 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”.

Annex A: Glossary of terms and conversion factors

Definition of biodiesel and bioethanol (Source: Chapter 6, paragraph 6.125 and 6.126 of DUKES 2016)

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 labelled¹⁴.

Conversions

- Tonnes of oil equivalent to gigajoules
1 tonne of oil equivalent=41.868 gigajoules.

Source DUKES Chapter 1 (Energy) paragraph 1.29.

<https://www.gov.uk/government/statistics/energy-chapter-1-digest-of-united-kingdom-energy-statistics-dukes>

- Calorific values of fuels to convert gigajoules to tonnes are available at Annex A of DUKES, A.1 and A.2:
https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/541006/Annex_A_web.pdf

Megajoules to litres

Bioethanol= 23.6 megajoules per litre,

Biodiesel= 34.4 megajoules 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 = 1 tonne of corn

Source: Department for Transport <https://www.gov.uk/government/publications/rfo-guidance> and [The National Non-Food Crops Centre](#)

¹⁴ 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 were 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 Directive¹⁵ 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> for 2013/12 (Year 5) at <https://www.gov.uk/government/statistics/biofuel-statistics-year-5-2012-to-2013-report-6> for 2013/14 (Year 6) at <https://www.gov.uk/government/statistics/biofuel-statistics-year-6-2013-to-2014-report-6> and for 2013/15 (Year 7) at: <https://www.gov.uk/government/statistics/biofuel-statistics-year-7-2014-to-2015-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.

¹⁵ 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 Directive¹⁶ (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 Renewable Energy STATistics (RESTATS) Questionnaire

From 2010, to estimate the volume of biofuels produced in the UK, an annual renewable energy survey has been carried out by The Department for Business, Energy and Industrial Strategy (formally The Department for Energy and Climate Change). Neither HMRC or RTFO figures can be used for this purpose since they include both UK produced fuels and imports. The survey is carried out by Ricardo Energy & Environment on behalf of BEIS. 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 The Department for Business, Energy and Industrial Strategy. 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>

¹⁶ 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-crop-areas-and-livestock-populations-at-june-2016-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 could 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

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

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

<https://www.ofgem.gov.uk/publications-and-updates/biomass-sustainability-dataset-2014-15> (2014/15 data)

B6. WRAP Organics Recycling Survey 2012

The WRAP Organics Recycling Survey 2012¹⁷ 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 Map¹⁸ 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 study¹⁹ 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.

¹⁷ 2012 WRAP Survey of UK Organics Recycling Industry: <http://www.wrap.org.uk/sites/files/wrap/ASORI%202012.pdf>

¹⁸ Available at: www.biogas-info.co.uk

¹⁹ <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). This quota will apply until 30 September 2017 after which sugar production quotas will be abolished.

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 3).