



## EXPERIMENTAL STATISTICS

### Area of Crops Grown For Bioenergy in England and the UK: 2008 - 2012

According to the arrangements approved by the UK Statistics Authority, Defra has released updated experimental statistics on the areas of oilseed rape, sugar beet, wheat, miscanthus, short rotation coppice and straw crops grown in the UK for use as bioenergy. The release also includes a new section on anaerobic digestion. These results will be of interest to policy advisors, non-food crop promoters and processors.

It is important to note that these are experimental statistics. Existing data from a range of sources have been combined to derive crop area estimates and there are certain limitations. They should be viewed and used with caution as the reliability and completeness have not been fully determined and the methodologies for producing them are still evolving, although much of the source data on which they are based are National Statistics. As such the crop area statistics have not yet been shown to meet the quality criteria for National Statistics branding, but are being published to involve users in their development and to help build in quality whilst these statistics are evolving. A fuller description of the limitations of these statistics is provided within each section.

This is the third statistical release on this subject area. The intention is for the notice to be updated annually as the data sources and methodologies evolve. The next update is expected to be released in autumn 2014. Once confirmed the exact date will be published on the internet at:

[https://www.gov.uk/government/uploads/system/uploads/attachment\\_data/file/254892/Defra\\_statistical\\_release\\_calendar.pdf](https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/254892/Defra_statistical_release_calendar.pdf)

**Revised on 12 March 2014:** Annex B, B.1 was updated and the reporting period dates in tables 2 - 6 make clear the reporting period is from mid-April each year. There are no changes to the actual data.

#### Key results

- Approximately 26 thousand hectares or 0.4% of UK arable land planted in 2011 were grown for production of bioenergy during 2012.
- This comprised of 6 thousand hectares of oilseed rape, 3 thousand hectares of sugar beet and 6 thousand hectares of wheat. These areas produced 303 thousand tonnes of crop for biofuel production for the UK road transport market.
- A further 8 thousand hectares of miscanthus and 3 thousand hectares of short rotation coppice grown in England were used for bioenergy production. Approximately 45 thousand tonnes of miscanthus and 14 thousand tonnes of short rotation coppice were used in power stations for electricity generation in 2011/12.
- Around 215 thousand tonnes of straw (approximately 2% of typical production) were used as fuel in biomass power stations in England in 2011/12.
- In 2012, 389 thousand tonnes of purpose grown crops were fed into on-farm anaerobic digestion plants in the UK, while 16 thousand tonnes were fed into commercial plants.

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These statistics are produced free from any political interference. You can find information about National Statistics on the internet at [www.statistics.gov.uk](http://www.statistics.gov.uk).

**Defra statistical releases**, including details of future publication dates, and can be viewed on the Defra website at: [https://www.gov.uk/government/uploads/system/uploads/attachment\\_data/file/254892/Defra\\_statistical\\_release\\_calendar.pdf](https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/254892/Defra_statistical_release_calendar.pdf)

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## Overview

The table below shows the UK land areas used in agriculture and the areas used to produce crops for bioenergy. These are based on information from Tables 3 - 7 which use conversion factors to derive crop tonnages and areas from volumes of biofuel. Data for areas of crops used to produce biofuel in 2012 are provisional and are subject to change.

**Table 1: UK land areas used for agriculture**

	Thousand hectares				
	2008	2009	2010	2011	2012
<b>Total utilised agricultural area (UAA)<sup>(a)</sup></b>	<b>17 703</b>	<b>17 325</b>	<b>17 234</b>	<b>17 172</b>	<b>17 190</b>
UAA as a proportion of total UK area	73%	71%	71%	70%	70%
Total arable area <sup>(b)</sup>	5 900	5 922	5 847	5 932	6 086
Wheat of which:	2 080	1 775	1 939	1 969	1 992
<i>used for bioethanol<sup>(c)</sup></i>	0	0	75	6	20
Barley	1 032	1 143	921	970	1 002
Oilseed rape of which:	598	570	642	705	756
<i>used for biodiesel<sup>(c)</sup></i>	15	18	8	6	2
Sugar beet of which:	120	114	118	113	120
<i>used for bioethanol<sup>(c)</sup></i>	7	9	14	3	10
Maize (fodder and grain)	153	163	164	164	158
Short rotation coppice (England only)	6	4	3	3	3
Miscanthus (England only)	7	9	9	8	8
Uncropped arable land	194	244	174	156	153
Temporary grass under 5 years old	1 141	1 241	1 232	1 278	1 357
Permanent grassland (incl. sole right rough grazing)	10 395	9 996	9 980	9 858	9 725
UK area used for biofuel crops <sup>(c)</sup>	22	27	97	16	32
UK area used for bioenergy crops <sup>(c)</sup>	36	40	109	26	42
% of UK arable area used for biofuel crops <sup>(c)</sup>	0.4%	0.5%	1.7%	0.3%	0.5%

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

tbc: to be confirmed (bioethanol production/usage data for the 2012 crop is not yet available)

(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) 2012 figures are provisional and are subject to revision.

For further information about each of the June surveys please visit the respective website of each UK country:

**England:** <https://www.gov.uk/government/collections/structure-of-the-agricultural-industry>

**Scotland:** <http://www.scotland.gov.uk/Topics/Statistics/Browse/Agriculture-Fisheries/PubFinalResultsJuneCensus>

**Wales:** <http://wales.gov.uk/topics/statistics/?lang=en>

**Northern Ireland:** <http://www.dardni.gov.uk/statistical-bulletins>

**For further enquiries on the June Survey dataset, please contact:** Farming Statistics, Department for Environment, Food and Rural Affairs. Tel: 01904 455332, email: [farming-statistics@defra.gsi.gov.uk](mailto:farming-statistics@defra.gsi.gov.uk)

# 1 Biofuels

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](http://ec.europa.eu/energy/renewables/biofuels/biofuels_en.htm)) for 10% of final energy consumption in the transport sector to be supplied from renewable sources by 2020. The Renewable Transport Fuels Obligation (RTFO) is one of the Government's main policies for reducing greenhouse gas emissions from road transport in the UK by encouraging the supply of renewable fuels. Obligated suppliers must supply a certain percentage<sup>1</sup> 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/government/uploads/system/uploads/attachment\\_data/file/255320/rtfo-2012-13-year-5-report-5.pdf](https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/255320/rtfo-2012-13-year-5-report-5.pdf) ). The use of biofuels also supports other Government objectives to improve security of energy supply and rural development.

## Key facts

- In 2011/12, just over 300 thousand tonnes of UK grown crops were used for biofuel production, supplied primarily to the UK road transport market. This equates to around 16 thousand hectares of crops (0.3% of the total UK arable area) comprising in 2011 of: 1% of the UK oilseed rape area, 3% of the sugar beet area and less than 1% of the UK wheat area.
- The tonnage of UK grown crops used for biofuel production in 2011/12 showed a decrease of 77% compared to 2010/11 usage of 1.3 million tonnes. The main driver behind this decrease was the temporary closure in May 2011 of (at that time) the UK's only grain fed bioethanol plant. This resulted in a 92% decrease in the tonnage of wheat used from 581 thousand tonnes in 2010/11 to 49 thousand tonnes in 2011/12. The tonnage of sugar beet used for bioethanol also decreased in 2011/12 by 68% to 230 thousand tonnes.

## 1.1 Overview of data sources and methodology

- **The June Survey of Agriculture and Horticulture** is an annual survey which collects information from farmers on the area of crops grown in the UK at the 1st June each year. In the past, attempts have been made to ask farmers to separately report the area of crops grown for different purposes e.g. food, feed, bioenergy but this has not proved successful because farmers do not always know the end use, especially at the time the survey is run.

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. It should be noted that none of the

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<sup>1</sup>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.

sources used have been set up specifically for the purpose of establishing crop areas used for bioenergy so there are some limitations in the data which are outlined in each section. An outline of the two main data sources can be found below with more detailed information given in [Annex B](#).

- **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. In the case of sugar beet, very little (if any) bioethanol produced from the UK crop is exported; this is not the case for oilseed rape or wheat.

- **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.

## **1.2 UK grown crops used for the production biofuels for supple to the UK road transport market**

Table 2 summarises the 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 both been included to show how the type of feedstock has changed each year. Figures for 2012/13 are included for completeness, however as these data are still provisional and subject to revision the commentary is based around the finalised 2011/12 figures.

In 2011/12, the decrease in volume of home grown oilseed rape and the increase in the volume of used cooking oil may be explained by the continuing effect of a change in duty which came into force on 1 April 2010. From this date, the duty payable on biodiesel and bioethanol was increased by 20 pence/litre equalling that for diesel/petrol, whilst biodiesel made from used cooking oil continued to benefit from the 20p duty differential until April 2012, via a relief scheme.

The significant increase in wheat usage 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.

**Table 2: Volume of UK sourced biofuels supplied to the UK road transport market for 2008/09 - 2012/13, by crop type and by-products (years relate to mid April - mid April)**

Fuel type	UK sourced biofuels used in the UK road transport market (Volume of biofuels million litres or kg <sup>(a)</sup> )					% change 2011/12 to 2012/13
	2008-09	2009-10	2010-11	2011-12	2012-13 (provisional) <sup>(c)</sup>	
<b>Biodiesel of which:</b>	<b>67.3</b>	<b>101.5</b>	<b>142.5</b>	<b>149.4</b>	<b>173.5</b>	<b>16%</b>
Oilseed rape	26.3	31.6	14.5	12.8	3.7	-71%
Tallow (by-product)	5.2	40.0	21.6	6.1	30.2	398%
Used cooking oil (by-product)	35.9	29.8	106.4	130.5	139.6	7%
<b>Bioethanol of which:</b>	<b>41.4</b>	<b>63.9</b>	<b>188.4</b>	<b>39.8</b>	<b>108.1</b>	<b>172%</b>
Sugar beet	41.4	63.0	68.5	21.8	59.9	174%
Wheat	0.0	0.9	119.9	17.9	48.2	168%
<b>Biogas (MSW<sup>(b)</sup>)</b>	<b>0.4</b>	<b>0.2</b>	<b>0.4</b>	<b>0.7</b>	<b>1.2</b>	<b>68%</b>
<b>Pure vegetable oil</b>				<b>0.1</b>	<b>0.2</b>	<b>119%</b>
<b>Total UK sourced biofuel</b>	<b>109.1</b>	<b>165.6</b>	<b>331.3</b>	<b>190.0</b>	<b>283.1</b>	<b>49%</b>
UK sourced biofuels as a proportion of total biofuels used in UK road transport market	9%	11%	22%	12%	21%	

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) MSW= Municipal Solid Waste.

(c) 2012-13 figures are as of 15 September 2013 and not final.

The following tables 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. The summary table below is followed by detailed information for individual crops. Figures for 2012/13 (Year 5) are included for completeness, these data are still provisional and subject to revision.

**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 - 2012/13**

All UK crops used as biofuels (RTFO Year: 15 April n-1 to 14 April n)	Total volume of biofuels from UK grown crops (million litres)	Tonnage of crop implied ('000 tonnes) <sup>(a)</sup>	Area implied '000 ha and % of UK total arable area <sup>(b)</sup>
Year 1: 15 April 2008 - 14 April 2009	67.6	485	22.0 (0.4%)
Year 2: 15 April 2009 - 14 April 2010	95.5	726	27.0 (0.5%)
Year 3: 15 April 2010 - 14 April 2011 <sup>(c)</sup>	294.9	1 329	98.1 (1.7%)
Year 4: 15 April 2011 - 14 April 2012	52.6	303	15.6 (0.3%)
Year 5: 15 April 2012 – 14 April 2013 (provisional) <sup>(d)</sup>	111.8	770	32.3 (0.5%)

(a) Based on conversions from Department for Transport commissioned research. Details provided in the following tables

(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, available at:

<https://www.gov.uk/government/collections/structure-of-the-agricultural-industry>

(c) This includes an estimated 92 million tonnes of bioethanol produced from wheat used for markets other than for UK Road Transport.

(d) Figures for 2012-13 (Year 5) are as of 15 September 2013 and are not final.

### 1.3 Oilseed rape (for biodiesel)

The crop areas presented here include only biodiesel from UK grown crops sold into the UK road fuel market. Any other UK grown crops which are processed into biofuels and then exported (and not re imported) are not included, leading to an element of under recording. It has not been possible to quantify this potential under recording in the past as HMRC trade data and DECC results from the renewable energy survey did not differentiate between the different biodiesel feedstocks. However, new questions included on the 2012 survey questionnaire asked for volume and type of feedstock (see Table 14). Differences in the reporting period mean we cannot make a direct comparison at this time but as more data are gathered this should be possible.

**Table 4: UK oilseed rape areas used for biodiesel supplied to the UK road transport market, 2008/09 - 2012/13**

Oilseed Rape (RTFO Year: 15 April n-1 to 14 April n)	Volume of biodiesel (million litres)			Tonnage of crop implied ('000 tonnes) <sup>(c)</sup>	OSR yield (t/ha) <sup>(d)(e)</sup>	Area implied '000 ha & % of UK total OSR area <sup>(e)</sup>
	UK grown crop	of which: on previously cropped land <sup>(a)</sup>	of which: voluntary scheme - met land criteria <sup>(b)</sup>			
Year 1: 15 April 2008 - 14 April 2009	26.3	14.5		50	3.3	15.1 (3%)
Year 2: 15 April 2009 - 14 April 2010	31.6	21.7		60	3.4	17.7 (3%)
Year 3: 15 April 2010 - 14 April 2011	14.5	5.1		28	3.5	7.9 (1%)
Year 4: 15 April 2011 - 14 April 2012	12.8	3.4	1.7	24	3.9	6.2 (1%)
Year 5: 15 April 2012 - 14 April 2013 (provisional) <sup>(f)</sup>	3.7	1.0	2.7	7	3.4	2.1 (0.3%)

(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) Conversion: 526 litres biodiesel = 1 tonne oilseed rape (at 9% moisture). Source: Department for Transport commissioned research.

(d) Source: Defra annual Cereal and Oilseed Rape Production Survey (In 2012 the Cereal Production Survey and Oilseed Rape Production Survey were brought together to reduce costs) UK yield at year n-1.

<https://www.gov.uk/government/collections/structure-of-the-agricultural-industry>

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

<https://www.gov.uk/government/collections/structure-of-the-agricultural-industry>

(f) Figures for 2012-13 (Year 5) are as of 15 September 2013 and are not final.

### 1.4 Sugar beet (for bioethanol)

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 as reported in Table 5. Very little (if any) bioethanol produced from UK grown sugar beet is exported. Therefore, the areas below give a good indication of the total UK area of sugar beet used for bioethanol production.

Sugar beet yields have tended to increase year on year. An exception was 2010 when the crop was badly affected by the adverse weather conditions and production was significantly lower. The reduced availability meant less sugar beet went for biofuel production in RTFO Year 4 (2011/12). Yields recovered in 2011, exceeding the previous high achieved in 2009.

**Table 5: UK sugar beet areas used for bioethanol supplied to the UK road transport market 2008/9 - 2012/13**

Sugar beet (RTFO Year: 15 April n-1 to 14 April n)	Volume of bioethanol (million litres) <sup>(a)</sup>	Tonnage of crop implied ('000 tonnes) <sup>(b)</sup>	sugar beet yield (t/ha) <sup>(c)(d)</sup>	Area implied (thousand ha) and % of UK total sugar beet area <sup>(d)</sup>
Year 1: 15 April 2008 - 14 April 2009	41.4	435	64	6.8 (6%)
Year 2: 15 April 2009 - 14 April 2010	63.0	663	74	9.0 (8%)
Year 3: 15 April 2010 - 14 April 2011	68.5	721	55	13.4 (11%)
Year 4: 15 April 2011 - 14 April 2012	21.8	230	75	3.0 (3%)
Year 5: 15 April 2012 - 14 April 2013 (provisional) <sup>(e)</sup>	59.9	631	61	10.4 (9%)

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

(b) Conversion: 95 litres bioethanol = 1 tonne sugar beet. Source: Department for Transport commissioned research.

(c) 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>

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

<https://www.gov.uk/government/collections/structure-of-the-agricultural-industry>

(e) Figures for 2012-13 (Year 5) are as of 15 September 2013 and are not final.

## 1.5 Wheat (for bioethanol)

As with oilseed rape, any UK grown wheat locally processed into bioethanol and then exported (and not re-imported) is not included in the RTFO figures. Before 2010, volumes of UK grown wheat processed into bioethanol were relatively low suggesting little would have been available for export. The start up of a new UK bioethanol plant in 2010 led to an increase in UK grown wheat processed in that year, although subsequent temporary closures of the plant meant volumes decreased significantly in 2011/12 (again suggesting little would be exported). Table 6 shows the RTFO figures converted into crop areas.

**Table 6: UK wheat areas used to produce bioethanol supplied to the UK road transport market 2008/9 - 2012/13**

Wheat (RTFO Year: 15 April n-1 to 14 April n)	Volume of bioethanol (million litres) <sup>(b)</sup>	Tonnage of crop implied ('000 tonnes) <sup>(c)</sup>	wheat yield (t/ha) <sup>(d)(e)</sup>	Area implied (thousand ha) and % of UK total wheat area <sup>(e)</sup>
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 <sup>(a)</sup>	211.9	581	7.7	75.4 (4%)
Year 4: 15 April 2011 - 14 April 2012	17.9	49	7.7	6.3 (0%)
Year 5: 15 April 2012 - 14 April 2013 (provisional) <sup>(f)</sup>	48.2	132	6.7	19.6 (1%)

(a) This includes an estimated 92 million tonnes of bioethanol produced from wheat used for markets other than for UK Road Transport.

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

(c) Conversion: 365 litres bioethanol = 1 tonne wheat grain (at 15% moisture). Source: Department for Transport commissioned research.

(d) Source: Defra annual Cereal and Oilseed Rape Production Survey (In 2012 the Cereal Production Survey and Oilseed Rape Production Survey were brought together to reduce costs Cereal Production Survey) UK yield at year n-1. <https://www.gov.uk/government/collections/structure-of-the-agricultural-industry>

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

<https://www.gov.uk/government/collections/structure-of-the-agricultural-industry>

(e) Figures for 2012-13 (Year 5) are as of 15 September 2013 and are not final.

For 2010 it is possible to derive an estimate of the amount of UK produced bioethanol subsequently used in other markets/exported by comparing the RTFO figures to the results from the DECC renewable energy survey (see [Section 1.1](#) and [Annex B](#)). In 2010 it was reported that around 52% of the UK bioethanol produced from UK wheat went into markets other than the UK road transport market.

**Table 7: Estimated 2010 UK wheat area used for producing bioethanol used for markets other than UK road transport and/or exported**

Data source	Bioethanol usage	Million litres	Area implied ('000 ha)
DECC	Volume produced in the UK 2010 (includes subsequent exports)	281	
	Volume used in the UK	212	
RTFO	From wheat	120	
RTFO	From sugar beet	69	
Derived	Bioethanol from wheat exported from UK (derived from figures above) <sup>(a)</sup>	92	32.7

(a) As very little bioethanol from sugar beet is exported, the assumption is made that this is all from wheat.

## 1.6 Supply of biofuels to the UK and associated crop areas (RTFO data)

Table 8 shows area estimates for all countries supplying biofuels from crops into the UK. The area estimates differ slightly from those presented for oilseed rape in Table 4 because the volumes used have been adjusted to include 'unknown' country and feedstock data. Overall 1% of the biofuel supplied to the UK came from an 'unknown' country of origin and this volume has been distributed across the 'knowns' in proportion to the known volumes. The UK yield figures used in the calculations are based on Defra survey data (see Tables 3 -7). Yield figures for other crops are taken from 2011 Food and Agriculture Organisation (FAO) Statistics with the exception of palm yield, which is from the Renewable Fuel Agency's Carbon & Sustainability Technical Guidance (Version 2 part 2 for year two).

**Table 8: RTFO estimated global land areas used for UK biofuels 2011/12**

	Feedstock	Country of origin	Volume of biofuel supplied in UK (million litres)	Estimated land area to supply biofuel (thousand ha)
Biodiesel	Oilseed rape <sup>(a)</sup>	Australia	2.1	3.5
		France	20.8	11.5
		Germany	14.9	9.7
		Lithuania	1.8	1.7
		Netherlands	6.7	3.7
		Poland	5.5	4.7
		Ukraine	1.4	1.5
United Kingdom		14.0 (12.8)	6.8 (6.2)	
Palm	Indonesia	5.9	1.1	
Soy	Argentina	23.3	46.0	
	Brazil	0.8	1.3	
	USA	2.1	3.9	
Bioethanol	Barley	Spain	6.2	6.4
	Corn	France	25.0	6.3
		Hungary	13.5	5.2
		Romania	0.0	0.0
		Serbia	0.0	0.0
		Spain	32.3	7.1
		United Kingdom	0.0	0.0
		Ukraine	8.4	3.3
		United States	477.7	129.9
	Sugar beet	United Kingdom	21.8	3.0
	Sugar cane	Brazil	0.9	0.1
	Sweet sorghum	United States	10.3	9.0
	Wheat	France	9.9	4.2
		Hungary	0.0	0.0
		Romania	0.0	0.0
Spain		4.2	3.3	
Ukraine		3.7	3.0	
United Kingdom		17.9	6.3	
Total		731.1	282.6	
% from UK feedstocks <sup>(c)</sup>		7%	6%	

(a) These values differ to those presented in other parts of this report as they have been adjusted to include 'unknown' country and feedstock data (distributed across the 'knowns' in proportion to the known volumes).

Figures in brackets refer to the purely UK specified feedstocks i.e. are not adjusted to include 'unknown' sourced crop and are included here for comparison purposes.

(c) Percentage for UK feedstocks based on unadjusted UK figures.

Source: RTFO report Year 4 report 6 (2011/12)

[http://webarchive.nationalarchives.gov.uk/20110407094507/http://www.renewablefuelsagency.gov.uk/sites/rfa/files/Year\\_Two\\_RTFO\\_v2.pdf](http://webarchive.nationalarchives.gov.uk/20110407094507/http://www.renewablefuelsagency.gov.uk/sites/rfa/files/Year_Two_RTFO_v2.pdf)

Yield information sources: 2011 country crop yields (except palm) from FAO data:

<http://faostat.fao.org/site/567/default.aspx#ancor>

Palm yield data: Renewable Fuel Agency's Carbon & Sustainability Technical Guidance (Version 2 part 2 for year two):

<http://webarchive.nationalarchives.gov.uk/20110407094507/http://www.renewablefuelsagency.gov.uk/sites/rfa/files/RFA%20CS%20TG%20Part%202%20v2.1.pdf>

The following five tables give further breakdowns of the RTFO data. These compare the biofuel volumes used in road transport each year against the total volumes of fuels supplied to the UK and the proportions that are UK sourced. The years are financial years i.e. April to March. Figures for 2012-13 are included for completeness but are as of 15 September 2013 and are not final.

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

Fuel type	(million litres or kg <sup>(a)</sup> )			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 2012-2013 <sup>(b)</sup>	Total volume of road transport fossil fuels supplied to UK 2012-13		
<b>Biodiesel of which:</b>	<b>173.5</b>	493	25 833	35%	1.1%
<i>Oilseed rape</i>	3.7				
<i>Tallow (by-product)</i>	30.2				
<i>Used cooking oil (by-product)</i>	139.6				
<b>Bioethanol of which:</b>	<b>108.1</b>	782	17 466	14%	1.8%
<i>Sugar beet</i>	59.9				
<i>Wheat</i>	48.2				
<b>Biogas (MSW<sup>(c)</sup>)</b>	<b>1.2</b>	1.2		100%	0.0%
<b>Biomethanol</b>	<b>0.0</b>	35		0%	0.1%
<b>MTBE (renewable portion)</b>	<b>0.0</b>	28		0%	0.1%
<b>Pure vegetable oil</b>	<b>0.2</b>	0.2		100%	0.0%
<b>Total</b>	<b>283.1</b>	1 340	43 366	21%	3.0%
<b>Annual target</b>					4.5%

Source: <https://www.gov.uk/government/publications/renewable-transport-fuel-obligation-statistics-year-5-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) MSW= Municipal Solid Waste.

**Table 10: RTFO Year 4 (2011/12) biofuel from UK feedstocks**

Fuel type	(million litres or kg <sup>(a)</sup> )			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 2011-12	Total volume of biofuels supplied to UK 2011-2012 <sup>(b)</sup>	Total volume of road transport fuels supplied to UK 2011-12		
<b>Biodiesel of which:</b>	<b>149.4</b>	933	25 267	16%	2.0%
<i>Oilseed rape</i>	12.8				
<i>Tallow (by-product)</i>	6.1				
<i>Used cooking oil (by-product)</i>	130.5				
<b>Bioethanol of which:</b>	<b>39.8</b>	698	18 776	6%	1.5%
<i>Sugar beet</i>	21.8				
<i>Wheat</i>	17.9				
<b>Biogas (MSW<sup>(c)</sup>)</b>	<b>0.7</b>	0.7		100%	<0.01%
<b>Biomethanol</b>	<b>0.0</b>	2.4			0.01%
<b>Pure vegetable oil</b>	<b>0.1</b>	0.2			<0.01%
<b>Total</b>	<b>189.9</b>	<b>1 632</b>	<b>44 043</b>	<b>12%</b>	<b>3.6%</b>
<b>Annual target</b>					4.0%

Source: <https://www.gov.uk/government/publications/renewable-transport-fuel-obligation-statistics-obligation-period-4-2011-12-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.

**Table 11: RTFO Year 3 (2010/11) biofuel from UK feedstocks**

Fuel type	Million litres or kg <sup>(a)</sup>			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 2010-11	Total volume of biofuels supplied to UK 2010-11 <sup>(b)</sup>	Total volume of road transport fuels supplied to UK 2010-11		
<b>Biodiesel of which:</b>	<b>142.5</b>	899	24 958	16%	3.5%
<i>Oilseed rape</i>	14.5				
<i>Tallow (by-product)</i>	21.6				
<i>Used cooking oil (by-product)</i>	106.4				
<b>Bioethanol of which:</b>	<b>188.4</b>	618	19 876	30%	3.0%
<i>Sugar beet</i>	68.5				
<i>Wheat</i>	119.9				
<b>Biogas (MSW<sup>(c)</sup>)</b>	<b>0.4</b>	0.4		100%	na
<b>Total</b>	<b>331.3</b>	<b>1 517</b>	<b>44 834</b>	<b>22%</b>	<b>3.3%</b>
<b>Annual target</b>					3.5%

Source: <http://assets.dft.gov.uk/statistics/releases/verified-rtfo-biofuel-statistics-2010-11/year-3-verified-report.pdf> (see the RTFO Summary tables within the reports).

(a) Biodiesel and bioethanol 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.

**Table 12: RTFO Year 2 (2009/10) biofuel from UK feedstocks**

Fuel type	Million litres or kg <sup>(a)</sup>			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 2009-10	Total volume of biofuels supplied to UK 2009-10 <sup>(b)</sup>	Total volume of road transport fuels supplied to UK 2009-10		
<b>Biodiesel of which:</b>	<b>101.5</b>	1 113	24 371	9%	4.4%
<i>Oilseed rape</i>	31.6				
<i>Tallow (by-product)</i>	40.0				
<i>Used cooking oil (by-product)</i>	29.8				
<b>Bioethanol of which:</b>	<b>63.9</b>	455	21 216	14%	2.1%
<i>Sugar beet</i>	63.0				
<i>Wheat</i>	0.9				
<b>Biogas (MSW <sup>(c)</sup>)</b>	<b>0.2</b>	0.2		100%	na
<b>Total</b>	<b>165.6</b>	1 568	45 587	11%	3.3%
<b>Annual target</b>					3.3%

Source: [http://webarchive.nationalarchives.gov.uk/20110407094507/http://www.renewablefuelsagency.gov.uk/site/s/rfa/files/Year\\_Two\\_RTFO\\_v2.pdf](http://webarchive.nationalarchives.gov.uk/20110407094507/http://www.renewablefuelsagency.gov.uk/site/s/rfa/files/Year_Two_RTFO_v2.pdf) (see the RTFO Summary tables within the reports).

(a) Biodiesel and bioethanol 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.

**Table 13: RTFO Year 1 (2008/09) biofuel from UK feedstocks**

Fuel type	Million litres or kg <sup>(a)</sup>		UK sourced biofuels as a proportion of total biofuels supplied to UK	Biofuels as a proportion of total road transport fuels supplied to UK <sup>(d)</sup>
	Volume UK sourced biofuels 2008-09	Total volume of biofuels supplied to UK 2008-09 <sup>(b)</sup>		
<b>Biodiesel of which:</b>	<b>67.3</b>	1 058	6%	
<i>Oilseed rape</i>	26.3			
<i>Tallow (by-product)</i>	5.2			
<i>Used cooking oil (by-product)</i>	35.9			
<b>Bioethanol of which:</b>	<b>41.4</b>	225	18%	
<i>Sugar beet</i>	41.4			
<i>Wheat</i>	0.0			
<b>Biogas (MSW <sup>(c)</sup>)</b>	<b>0.4</b>	0.4	100%	
<b>Total</b>	<b>109.1</b>	1 284	9%	2.7% <sup>(d)</sup>
<b>Annual target</b>				2.5%

Source: <http://www.official-documents.gov.uk/document/other/9780108508868/9780108508868.pdf> (see the RTFO Summary tables within the reports).

(a) Biodiesel and bioethanol 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.

(d) Due to the identification of a discrepancy in the RTFO Order, data were not collected on the total supply of fossil road transport fuel in 2008/09. Hence figures are unavailable on the percentage of biofuel for the first obligation year. The percentage figure supplied is derived from HMRC data for May 2008 to April 2009. Note that this period does not tally completely with RFA/DfT data, but provides an approximation.

## 1.7 DECC Renewable Energy STATistics (RESTATS) Questionnaire

The RTFO data only provides information about the amounts of UK feedstock used to produce biofuel for UK road transport supplies. However, this excludes any UK produced biofuel that may be exported or go to markets other than road transport. The Department for Energy and Climate Change (DECC) conduct an annual survey of large scale biofuel production. The survey aims to determine total UK production of biofuels and also combines data on small scale production from HM Revenue and Customs. Results for 2010 to 2012 are presented in Table 14.

**Table 14: DECC Renewable Energy Survey, UK biofuel production and supply to UK road transport market, 2010 - 2012**

Million litres						
	2010		2011		2012	
	Total UK biofuel production	Total biofuel supplied to UK road transport market	Total UK biofuel production	Total biofuel supplied to UK road transport market	Total UK biofuel production	Total biofuel supplied to UK road transport market
Biodiesel	175	1045	201	925	280	634
Bioethanol	281	631	29	652	154	775

Source: DECC Renewable Energy Survey

2010: [https://restats.decc.gov.uk/cms/assets/Uploads/Results\\_2010/ABSTRACT-UKBiofuelsProduction2010v2.pdf](https://restats.decc.gov.uk/cms/assets/Uploads/Results_2010/ABSTRACT-UKBiofuelsProduction2010v2.pdf)

2011: [https://restats.decc.gov.uk/cms/assets/Uploads/Results\\_2011/ABSTRACT-UK-Biofuels-Production-2011v1FINAL.pdf](https://restats.decc.gov.uk/cms/assets/Uploads/Results_2011/ABSTRACT-UK-Biofuels-Production-2011v1FINAL.pdf)

2012: [https://restats.decc.gov.uk/cms/assets/Uploads/Results\\_2012/ABSTRACTS-UK-Biofuels-Production-2012-v1.pdf](https://restats.decc.gov.uk/cms/assets/Uploads/Results_2012/ABSTRACTS-UK-Biofuels-Production-2012-v1.pdf)

In 2012, DECC's annual renewable energy survey (see [Annex B](#) for more details) included questions on the quantity and origin of crops used in UK biofuel production for the first time. Table 15 presents these initial results together with estimates of crop areas based on the quantity of UK produced feedstocks used. Because the DECC data relates to calendar years and the RTFO information financial years a direct comparison is not feasible at present. However, as more data are collected within the DECC survey comparison should become possible. As the DECC survey covers all biofuel production (including that subsequently exported and for markets other than road transport) the data could help build a more complete picture of the usage of UK crops for biofuel.

**Table 15: 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
<b>Biodiesel total</b>	<b>280</b>	<b>14</b>	<b>14</b>	<b>98%</b>	
of which: oilseed rape			14		4 (1%)
<b>Bioethanol total</b>	<b>154</b>	<b>96</b>	<b>816</b>	<b>95%</b>	
of which: wheat			232		34(2%)
sugar beet			550		4(3%)
maize grain <sup>(a)</sup>			34		

Source: DECC Renewable Energy Survey

(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.

### Key facts

- Around 0.2% of the 4.6 million hectares of arable land in England was used for growing miscanthus and SRC in 2012.
- Approximately 14 thousand tonnes of SRC were used in UK power stations for electricity in 2011/12. This compares to a total SRC production of around 16 thousand tonnes for England in 2011, based on low end assumptions of yields.
- Approximately 45 thousand tonnes of miscanthus were used in UK power stations for electricity in 2011/12. This is around half of all the miscanthus produced in England in 2011, based on low end assumptions of yields. There are other outlets for using miscanthus such as livestock bedding and, in small scale CHP plants or directly on farms or domestic premises for heating but the volumes used are not available.

### 2.1 Miscanthus areas

From 2008, official area estimates of miscanthus grown in England are available from the Defra June Survey of Agriculture (see Table 16). 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; estimates for other years are not sufficiently robust at a regional level given the sample size and associated confidence intervals. Miscanthus is grown on around 0.1% of the total arable area in England.

**Table 16: Total planned area of miscanthus in England<sup>(a)</sup>**

	Hectares					
	2008	2009	2010	2011	2012	2013 <sup>(b)</sup>
North East			0			
North West			70			
Yorks and Humberside			2 100			
East Midlands			2 503			
West Midlands			1 013			
East of England			642			
South East			366			
South West			1 964			
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	na

Source: Defra June Survey of Agriculture and Horticulture:

<https://www.gov.uk/government/collections/structure-of-the-agricultural-industry>

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:

<http://webarchive.nationalarchives.gov.uk/20130315143000/http://www.defra.gov.uk/statistics/files/defra-stats-foodfarm-landuselivestock-nonfoodcrops-latestrelease.pdf>

(b) The 2013 June Agricultural Survey had a sample size which should allow a regional breakdown to be produced for this year once survey processing is complete.

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). 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.

A summary of the newly planted areas claimed and the total subsidies paid under these schemes is shown in the two tables below. More details on the scheme are on the Natural England website at:

<http://www.naturalengland.org.uk/ourwork/farming/funding/ecs/default.aspx>.

Table 17 shows that the total area of new plantings claimed under subsidies since 2000 is 9,419 hectares. Comparing this to 2013 June Survey data for the area of miscanthus (7,078 hectares) suggests that over the years the vast majority of miscanthus will have been grown within the subsidy payment scheme.

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

Hectares

English Region	ECS1: 2000- 2006/7 area <sup>(a)</sup>	ECS2: 2007-2013 area <sup>(b)(c)</sup>						ECS2: 2007-2013 total area <sup>(c)</sup>	Total area claimed under ECS 2000-2013
		2008	2009	2010	2011	2012	2013		
North East	0	0	0	0	0	0	0	0	0
North West	63	0	0	0	14	14	32	60	123
Yorks & Humberside	1 843	32	43	83	132	102	34	426	2 269
East Midlands	1 890	45	100	91	119	242	122	719	2 609
West Midlands	859	24	90	81	180	376	306	1 057	1 916
East of England	381	0	0	34	83	67	25	209	590
South East	305	9	36	42	21	42	0	150	455
South West	1 036	22	211	114	40	21	14	422	1 458
<b>England total</b>	<b>6 376</b>	<b>132</b>	<b>480</b>	<b>445</b>	<b>589</b>	<b>864</b>	<b>533</b>	<b>3 043</b>	<b>9 419</b>

(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: 2007-2013: Additional area to that under ECS1. Summary of area under agreement and establishment grant payments made. Figures supplied direct from Natural England and show the position as at November 2013.

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

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 here as additional area.

**Table 18: Establishment grant payments for Miscanthus under the Energy Crops Scheme**

Thousand £

English Region	ECS1: 2000-2006 <sup>(a)</sup>	ECS2:2007-2013 <sup>(b)(c)</sup>	Total grant paid to date 2000-2013
North East	0	0	0
North West	58	58	116
Yorks & Humberside	1 695	341	2 036
East Midlands	1 738	523	2 261
West Midlands	790	693	1 484
East of England	347	205	551
South East	281	137	418
South West	953	283	1 236
<b>England total</b>	<b>5 861</b>	<b>2 241</b>	<b>8 102</b>

(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 Natural England website at:

<http://www.naturalengland.org.uk/ourwork/farming/funding/ecs/default.aspx>

(b) ECS2: 2007-2013: Additional area to that under ECS1. Summary of area under agreement and establishment payments made. Figures supplied direct from Natural England and show the position at November 2013.

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

## 2.2 Size of farms growing miscanthus

Table 19 shows the numbers and areas of farms growing miscanthus for 2010. A full census was carried out in this year allowing greater confidence in sub-national estimates. The 2013 June Agricultural Survey had a sample of size which should be sufficient to allow a similar breakdown to be produced once survey processing is complete. In 2010 there were around 400 miscanthus growers; more than one third (37%) of these had at least 20 hectares of miscanthus and so are undertaking quite large scale projects. These farms account for almost three quarters (72%) of the total miscanthus area.

**Table 19: Numbers and areas of farms with Miscanthus by size band: England 2010**

Area of Miscanthus	2010			
	Number of farms	Area of Miscanthus (hectares)	% of Miscanthus farms	% of Miscanthus area
0.1 to less than 5 hectares	67	157	17	2
5 to less than 10 hectares	71	560	18	6
10 to less than 20 hectares	116	1 667	29	19
20 to less than 50 hectares	123	3 726	31	43
50 hectares and over	26	2 548	6	29
<b>England</b>	<b>404</b>	<b>8 657</b>	<b>100</b>	<b>100</b>

Source: Defra June Census of Agriculture and Horticulture 2010.

## 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. For instance, the first year's growth is not suitable to harvest and yields then gradually improve to reach maturity over five years. The crop can continue to be harvested for 15-20 years. Planting method, species, site conditions, as well as the standard variations of region, annual weather conditions can also affect yield.

Taking all these factors into consideration, 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. To give some context to the area figures above, Table 20 shows the estimated volume of miscanthus produced in England each year based on both the upper (15) and lower (10) yield estimates from industry sources. These figures should be treated as broad estimates, rather than definitive figures because of the highlighted uncertainties in the yield estimates and the assumption that the whole of the area planted is productive which will not be the case for recently planted crops.

**Table 20: 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.

## 2.4 Miscanthus usage

Table 21 shows the volume of UK produced miscanthus which was used in UK power stations in 2009/10, 2010/2011 and 2011/12. The main power stations using this crop were Drax (Yorkshire), Kingsnorth (Kent), Ely (Cambridgeshire) and Fiddler's Ferry (Cheshire). A couple of others are also included but only use very small quantities (less than 100 tonnes per year). The data are collated by Ofgem as part of sustainability requirements under the Renewables Obligation.

**Table 21: Miscanthus usage in UK power stations 2009-10 – 2011/12<sup>(a)</sup>**

Biomass type and form	Volume used 2009-10 (tonnes)	Volume used 2010-11 (tonnes)	Volume used 2011-12 (tonnes)
<b>Miscanthus total <sup>(b)</sup> of which:</b>	<b>15 561</b>	<b>40 580</b>	<b>44 569</b>
Pure Miscanthus	3 705	28 171	33 184
Miscanthus blend <sup>(c)</sup>	11 857	12 409	11 385

Source: Ofgem Renewables Obligations dataset:

<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)

(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. The category of "clean woodchip and miscanthus" from Eccleshall was less than 2% (virtually all the material was woodchip, not miscanthus). (Staffordshire) was excluded as the energy crop proportion was less than 2% (virtually all the material was woodchip, not miscanthus).

(c) Blended with either cereal residues or wood.

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 17) not having reached productive maturity for use in the power plants. Other uses of miscanthus 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.

## 2.5 Short Rotation Coppice (willow or poplar) areas

As with miscanthus, the official area estimates of Short Rotation Coppice (SRC) grown in England are from the Defra June Survey of Agriculture which has collected these data from farmers since 2008. Table 22 also provides the estimated numbers of growers in each year. Regional crop areas are provided for 2010 only when a full census was carried out; regional estimates for other years are not sufficiently robust given the sample size and associated confidence intervals. SRC (since 2009) represents less than 0.1% of the total arable area in England.

**Table 22: Total planted area of Short Rotation Coppice grown in England**

English Region	2008	2009	2010	2011	2012	2013 <sup>(a)</sup>
North East			350			
North West			169			
Yorks & Humberside			911			
East Midlands			525			
West Midlands			71			
East of England			82			
South East			350			
South West			133			
England	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	na

Source: Defra June Survey of Agriculture and Horticulture

<http://www.defra.gov.uk/statistics/foodfarm/landuselivestock/junesurvey/>.

Defra analysis to produce regional figures and numbers of growers.

(a) The 2013 June Agricultural Survey had a sample size which should allow a regional breakdown to be produced once survey processing complete.

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 (see under [Section 2.1](#)). A summary of the newly planted areas claimed under the two rounds of this scheme are shown below in Tables 23 and 24, together with the total amounts paid under these schemes.

**Table 23: Area of SRC new plantings under the Energy Crops Scheme: England**

English Region	ECS1: 2000- 2006/7 area <sup>(a)</sup>	ECS2: 2007-2013 area <sup>(b)(c)</sup>						ECS2: 2007-2013 total area <sup>(c)</sup>	Total area claimed under ECS 2000-2013
		2008	2009	2010	2011	2012	2013		
North East	228	0	0	0	0	0	0	0	228
North West	125	0	0	0	0	0	3	3	128
Yorks & Humberside	464	11	3	29	61	33	0	137	601
East Midlands	609	49	91	91	34	42	0	307	916
West Midlands	27	0	0	0	0	0	0	0	27
East of England	76	0	14	6	21	30	0	71	147
South East	257	3	15	5	0	0	7	30	287
South West	31	3	5	2	0	0	0	10	41
<b>England total</b>	<b>1 815</b>	<b>66</b>	<b>128</b>	<b>133</b>	<b>116</b>	<b>105</b>	<b>10</b>	<b>558</b>	<b>2 373</b>

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: 2007-2013: Additional area to that under ECS1. Summary of area under agreement and establishment payments made. Figures supplied direct from Natural England and show the position at November 2013.

(c) Areas and amounts paid may be subject to change in future

As for miscanthus, comparing the total area of new plantings claimed under subsidies since 2000 (2,373 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.

**Table 24: Establishment grant payments for SRC under the Energy Crops Scheme**

Thousand £

English Region	ECS1: 2000-2006 <sup>(a)</sup>	ECS2: 2007-2013 <sup>(b)(c)</sup>	Total grant paid to date 2000-2013
North East	232	0	232
North West	123	2	125
Yorks & Humberside	470	84	554
East Midlands	597	190	787
West Midlands	28	0	28
East of England	76	46	122
South East	257	22	279
South West	31	6	37
<b>England total</b>	<b>1 812</b>	<b>351</b>	<b>2 162</b>

(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: 2007-2013: Additional area to that under ECS1. Summary of area under agreement and establishment payments made. Figures supplied direct from Natural England and show the position at November 2013.

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

## 2.6 Size of farms growing Short Rotation Coppice

The Defra Census of Agriculture 2010 estimates there were around 250 SRC growers in England (Table 25). A small number of growers produce the majority of SRC - 12% of SRC growers accounted for half the national area. A third of SRC growers (accounting for just 47 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. The 2013 June Agricultural Survey had a sample of size which should be sufficient to allow a similar breakdown to be produced once survey processing is complete.

**Table 25: Numbers and areas of farms with SRC by size band: England 2010**

Area of SRC	2010			
	Number of farms	Area of SRC (hectares)	% of SRC farms	% of SRC area
0.1 to less than 2 hectares	83	47	33	2
2 to less than 5 hectares	34	109	14	4
5 to less than 10 hectares	46	346	18	13
10 to less than 20 hectares	56	776	22	30
20 hectares and over	31	1 312	12	51
<b>England</b>	<b>251</b>	<b>2 591</b>	<b>100</b>	<b>100</b>

Source: Defra June Census of Agriculture and Horticulture 2010.

## 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 (the first harvest tends to be lower yielding than subsequent harvests), site conditions, type of planting method, crop type (willow or poplar) as well as the standard variations of region, annual weather conditions etc.

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 26 shows the estimated volume of SRC produced in England each year based on both the upper (12) and lower (6) yield estimates from industry sources.

These figures should be treated as broad estimates, rather than definitive figures as there is much uncertainty behind the yield estimates.

**Table 26: 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](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](http://www.biomassenergycentre.org.uk/portal/page?_pageid=75,18113&_dad=portal&_schema=PORTAL)

## 2.8 Short Rotation Coppice usage

The volume of UK produced SRC Willow which was used in power stations in the UK between 2009/10 and 2011/2012 is shown in Table 27. These power stations were Cottam (Nottinghamshire), Drax (Yorkshire), Steven's Croft (Scotland) and "Wilton 10" SembCorp biomass power station (Teeside). These data are collated by Ofgem, as part of sustainability requirements under the Renewables Obligation.

**Table 27: Short Rotation Coppice usage in UK power stations 2009-10 and 2011-12 <sup>(a)</sup>**

Biomass type and form	Volume used	Volume used	Volume used
	2009-10 (tonnes)	2010-11 (tonnes)	2011-12 (tonnes)
Short Rotation Coppice total of which:	<b>15 993</b>	<b>14 853</b>	<b>13927</b>
Willow (granules)	2 061	1 848	0
Willow (dust)	7 363	10 629	5182
Willow (pellets)	0	243	0
Willow (unknown form)	1 260	0	0
SRC (wood chips)	5 309	2 133	8745

(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 at:

<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)

The volumes recorded here are broadly similar to the lower end of production levels estimated in the previous table although, as with miscanthus, more recent plantings will not yet have reached maturity to harvest so would not be included in the usage data. There are few other end uses for SRC.

## 2.9 Other data sources on plant biomass usage

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). It is important to note that these figures cover all plant biomass, not just miscanthus and SRC. Figures cannot be disaggregated further due to the small volumes of these crops which would create disclosure issues.

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 28: Volume of plant biomass used in the UK to generate heat and electricity: 2000 to 2012**  
Thousand tonnes of oil equivalent

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

	2007	2008	2009	2010	2011	2012	% change 2011-12
<b>Total plant biomass used for heat/electricity of which:</b>	<b>888</b>	<b>900</b>	<b>1127</b>	<b>1447</b>	<b>1580</b>	<b>1721</b>	<b>9</b>
<b>Used to generate electricity</b>	<b>779</b>	<b>706</b>	<b>900</b>	<b>1177</b>	<b>1291</b>	<b>1446</b>	<b>12</b>
Co-firing with fossil fuels	641	517	533	765	765	401	-48
Plant Biomass <sup>(a)</sup>	138	189	367	412	527	1045	98
<b>Used to generate heat (plant biomass only) <sup>(b)</sup></b>	<b>109</b>	<b>194</b>	<b>227</b>	<b>270</b>	<b>288</b>	<b>275</b>	<b>-5</b>
Percentage used for electricity	88%	78%	80%	81%	82%	84%	

Source: Table 6.6 from Chapter 6 of the DECC Digest of UK Energy Statistics (DUKES) 2013

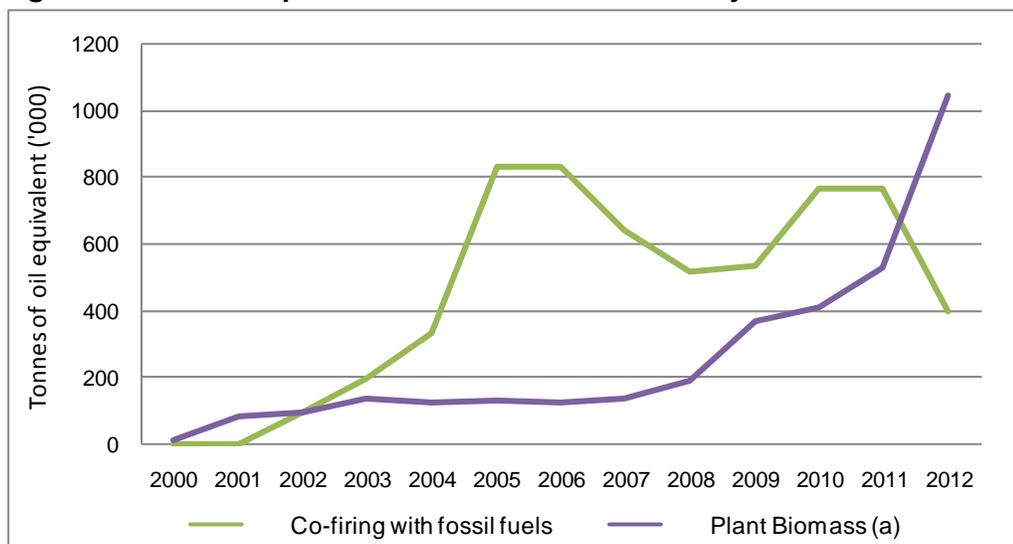
<https://www.gov.uk/government/publications/renewable-sources-of-energy-chapter-6-digest-of-united-kingdom-energy-statistics-dukes>

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. Figure 1 shows the volumes used for electricity over time. The data show 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 2012**



Source: Table 6.6 from Chapter 6 of the DECC Digest of UK Energy Statistics (DUKES) 2013

### 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.

#### Key facts

- 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.
- 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.
- Around 215 thousand tonnes of straw (2% of total straw production) was used as fuel in biomass power stations in England in 2011/12.

#### 3.1 UK Straw availability and usage

Data on straw availability and usage are scarce and official statistical survey data on yield and production are not available. Crop area data are available from the surveys of agriculture carried out in June each year across the UK administrations. These areas are shown in Table 29.

**Table 29: Selected UK cereal areas at June each year**

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

Source: June Survey of Agriculture: <https://www.gov.uk/government/collections/structure-of-the-agricultural-industry>

Typical recoverable cereal straw yields range between 2.75 to 4 tonnes/ha depending on crop type and harvest conditions (these yields are based on industry information and qualitative expert opinion). Normally around 60% of the straw produced can be baled and used for other purposes; the remaining stubble is incorporated back into the soil. Typical yields are 3.5 tonnes/ha for wheat and oats and 2.75 tonnes/ha for barley.

Straw production estimates based on these typical yields are shown in Table 30 to give a rough indication of scale. These figures should be treated as broad estimates as there is considerable variability in the underlying yield assumptions and seasonal variations (yields can vary by up to 30% depending on harvest conditions). Cereal straw production is generally around 9 to 10 million tonnes per year.

**Table 30: UK estimates of cereal straw production based on typical straw yields**

	Thousand tonnes							
	2005	2006	2007	2008	2009	2010	2011	2012
Wheat	6 535	6 426	6 407	7 281	6 214	6 785	6 893	6 972
Barley	2 579	2 424	2 469	2 838	3 143	2 533	2 667	2 756
Oats	316	425	453	473	452	436	380	427
Total	9 430	9 275	9 329	10 591	9 809	9 754	9 940	10 154

The 2010 Bioenergy Strategy by AEA (on behalf of DECC) provides commentary on volumes of straw usage by collating information from various pieces of research. This report gives estimates of supply/usage averaged over a 5 year period as a way of comparing the scale of usage by different sectors. The figures from the AEA report are shown below, along with translations of these volumes into equivalent cereal areas.

The report gives an average cereal straw production at 10.4 million tonnes per year. It also estimates an additional 2.5 million tonnes of oilseed rape straw which could also potentially be used, although there are drawbacks to using this type of straw (it is difficult to harvest and it not a good fuel for combustion). For this reason, later figures in these tables only relate to cereal straw usage.

The main usage of straw is for livestock bedding, followed by demand for animal feed (primarily barley straw). Power station usage is small and further breakdowns are available in [Section 3.3](#) of this release.

Table 31 suggests 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. This is explored further in [Section 3.2](#).

**Table 31: Estimates of cereal straw supply and demand in the UK**

UK Supply/Demand	thousand tonnes	% of cereal straw production	Implied cereal area ('000 ha) <sup>(a)</sup>
<b>Cereal straw availability<sup>(b)</sup></b>	10 400		3 116
<b>Cereal straw usage</b>			
Animal bedding <sup>(b)</sup>	5 800	56%	1 738
Animal feed <sup>(b)</sup>	2 000	19%	599
Mushroom industry <sup>(c)</sup>	40	0%	12
Power stations <sup>(d)</sup>	215	2%	64
<b>Surplus cereal straw resource available in the UK for other markets</b>	<b>2 360</b>	<b>23%</b>	<b>707</b>

(a) Area of wheat, barley and oats. Implied areas are calculated as the % of cereal straw production multiplied by the 2012 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) Tonnages sourced from Ofgem: Ofgem Annual Sustainability Report dataset (2011-12 data): <https://www.ofgem.gov.uk/publications-and-updates/annual-sustainability-report-2011-2012>

### 3.2 GB regional availability and usage of straw

The Central Science Laboratory (CSL) which is now known as the Food and Environmental Research Agency (FERA) produced a report in 2008 which analysed the regional availability of straw and compared it to livestock bedding requirements (CSL, 2008). Subtraction of the bedding requirements from regional straw supply identified a range of estimated straw supply/demand deficits across the GB regions. These are shown in the following table and in the following map (broken down further to county level).

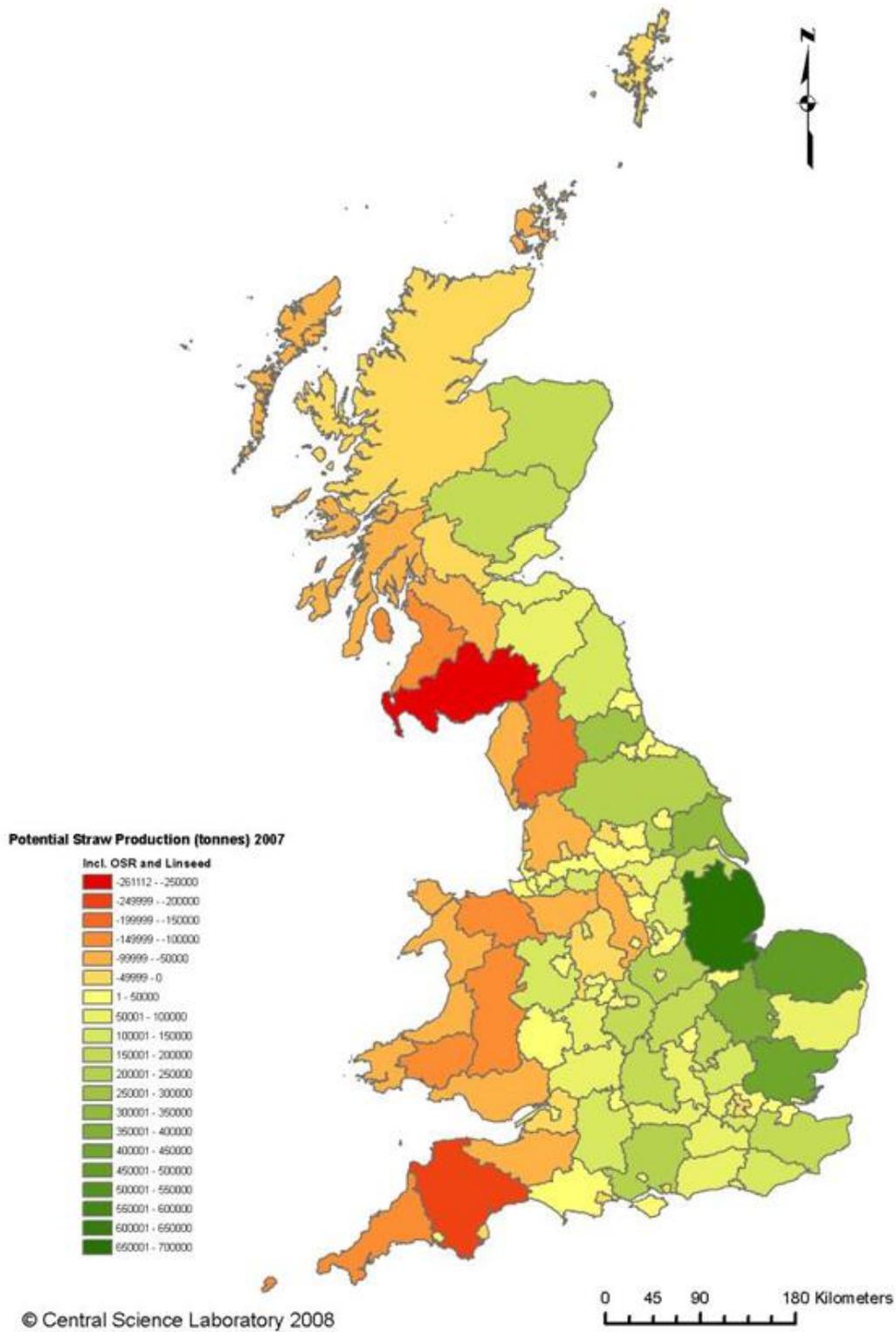
**Table 32: Potential cereal and oilseeds straw availability by GB region after deduction of estimated requirements for livestock bedding**

<b>GB region</b>	<b>Straw balance (thousand tonnes)</b>
North East	273
North West	- 394
Yorkshire and Humber	1 020
East Midlands	1 674
West Midlands	417
East of England	2 429
South East	1 102
South West	- 15
<b>England</b>	<b>6 506</b>
North West Scotland	- 80
North East Scotland	162
South East Scotland	422
South West Scotland	- 537
<b>Scotland total</b>	<b>- 33</b>
Carmarthenshire	- 136
Ceredigion	- 72
North East Wales	- 105
North West Wales	- 94
Pembrokeshire	- 99
Powys	- 135
South Wales	- 63
<b>Wales total</b>	<b>- 704</b>
<b>GB total</b>	<b>5 769</b>

Source: CSL, 2008: National and regional supply/demand balance for agricultural straw in Great Britain Taken directly from Table 2, page 9. <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>)

The map at Figure 2 shows the data broken down further to county level. Areas in yellow/green have an excess production of straw after deduction for livestock bedding. Areas in amber/red have a straw deficit so would need to bring in straw from other counties to meet their needs. This map shows that the Eastern counties tend to have surplus availability of straw whereas the Western counties use more than they produce so will be net importers of straw from other (Eastern) areas of the UK. Although the map is based on 2007 data, the current situation should be broadly similar to this. Livestock numbers are slightly reduced and there is no change to the current numbers of power stations using straw.

**Figure 2: The impact of livestock bedding requirements on regional cereal and oilseed straw supply/demand balance.**



Source: CSL, 2008. Reproduced with permission from the Central Science Laboratory, now the Food and Environmental Research Agency (FERA)

### 3.3 Power station usage of straw

Table 33 shows the volume of UK produced straw which was used in biomass power stations in England and Wales between 2009/10 and 2011/12. These data are collated by Ofgem as part of sustainability requirements in the Renewables Obligation.

**Table 33: Straw usage in English power stations 2009-10 - 2011/12<sup>(a)</sup>**

Biomass type and form	Volume used 2009-10 (tonnes)	Volume used 2010-11 (tonnes)	Volume used 2011-12 (tonnes)
<b>Straw total of which:</b>	<b>214 616</b>	<b>195 661</b>	<b>214 690</b>
Pellets (Drax, Yorkshire) <sup>(b)</sup>	28 073	47 034	41 184
Cereal straw (Ely, Cambridgeshire)	186 543	148 627	173 506

Source: Ofgem Annual Sustainability Report datasets at:

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

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

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

(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

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 where the map (Figure 4) indicates surplus straw supply.

**Table 34: 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
Tesco CHP Plant at Goole, East Yorkshire	Permission granted 2011	43
Wetwang, Yorkshire	Outline planning granted 2013	78
<b>Total</b>		<b>667</b>

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/>

Tesco CHP plant, Goole (permission status)

<http://www.eastriding.gov.uk/newpublicaccess/applicationDetails.do?activeTab=summary&keyVal=LMRY5KBJ0NO00>

Tesco CHP plant (potential volumes of straw to be used) <http://www.nfcc.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> )

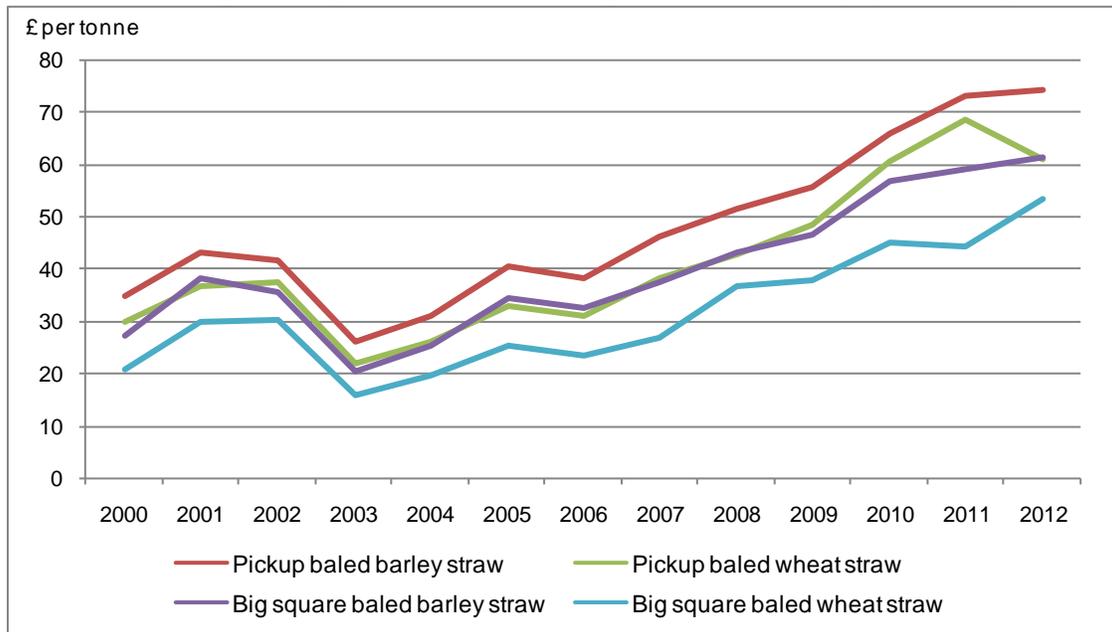
Wetwang: <http://www.eastriding.gov.uk/padocs/AUGUST2011/68D93C0E3CB211DF98B4AC53E757C93D.pdf>

### 3.4 Straw prices

Price can help provide an insight into supply/demand levels. The chart below shows the average price of straw since 2000 in England and Wales. The terms "Pickup baled" and "Big square baled" refer to the different methods used to collect and bale the straw which leads to price differentials.

Overall, the chart shows steadily rising prices since 2003 across all types of straw. However, there are significant monthly and regional variations which have been smoothed out by these annually averaged figures.

**Figure 3: Annual average farm price of straw in England and Wales (£ per tonne)**



Source: Monthly British Hay and Straw Merchants Association (via Defra) at: <http://www.defra.gov.uk/statistics/files/defra-stats-foodfarm-farmgate-commodity-haymth-120208.xls>

**Table 35: Annual average farm price of straw in England and Wales**

Year	£ per tonne			
	Pickup baled barley straw	Pickup baled wheat straw	Big square baled barley straw	Big square baled wheat straw
2000	35	30	28	21
2001	43	37	38	30
2002	42	37	36	30
2003	26	22	21	16
2004	31	26	26	20
2005	40	33	34	25
2006	38	31	33	23
2007	46	38	37	27
2008	51	43	43	37
2009	56	48	47	38
2010	66	60	57	45
2011	73	68	59	44
2012	74	61	61	53

## 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.

### Key facts

- In 2012, purpose grown crops accounted for 21% of total reported AD feedstocks.
- 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.
- Tonnages for individual crops used as feedstocks are not currently available.

### 4.1 Overview of data source

- The WRAP Organics Recycling Survey 2012<sup>2</sup> aimed to quantify the processing of organic wastes in the UK through a survey of key facilities including AD plants. For AD, a telephone survey achieved results from 61 of the 87 sites operational during 2012 (based on information from the official AD Information Portal Map<sup>3</sup> 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.

### 4.2 Use of purpose grown crops as feedstocks for AD

Figure 4 shows a breakdown of reported AD feedstocks in 2012 when purpose grown crops accounted for just over a fifth of all UK feedstocks. Along with manures these were mainly used by on-farm AD plants.

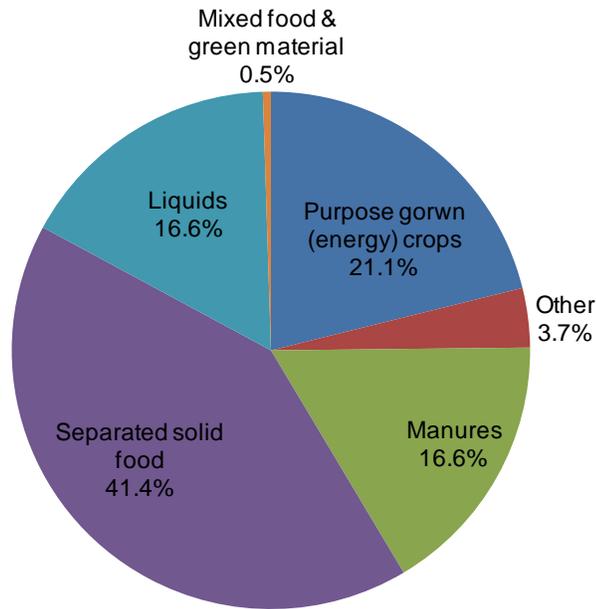
In 2012 the capacity of on-farm AD plants was 706 thousand tonnes. Inputs were 631 thousand tonnes of which 389 thousand tonnes were supplied from purpose grown crops. A further 16 thousand tonnes of purpose grown crops were also fed into commercial plants.

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<sup>2</sup> 2012 WRAP Survey of UK Organics Recycling Industry:  
<http://www.wrap.org.uk/sites/files/wrap/ASORI%202012.pdf>

<sup>3</sup> Available at: [www.biogas-info.co.uk](http://www.biogas-info.co.uk)

**Figure 4: 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

<http://www.wrap.org.uk/sites/files/wrap/ASORI%202012.pdf>

### **4.3 Types of crops used as feedstocks**

Types of crops suitable for use as feedstocks include maize, grass and oilseeds. While official statistics on the amount and type of crops used for AD are not currently available the British Society of Plant Breeders estimated that the area of forage maize grown as feedstock for biogas in 2013 was around 15,500 hectares, which is equivalent to 8% of the UK crop<sup>4</sup>. This was an increase on 2012 when they estimated that 4.5% of the forage maize crop was used in biogas production.

We will be exploring possible ways to gather crop feedstock data in the future.

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<sup>4</sup> [http://www.niab.com/news\\_and\\_events/article/286](http://www.niab.com/news_and_events/article/286)

## Annex A: Glossary of terms and conversion factors

Definition of biodiesel and bioethanol (Source: Chapter 6, paragraph 6.93 of DUKES 2013)

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

### Conversions

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

*Source DUKES Chapter 1 (Energy) paragraphs 1.28-1.29.*

[https://www.gov.uk/government/uploads/system/uploads/attachment\\_data/file/225067/DUKES\\_2013\\_published\\_version.pdf](https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/225067/DUKES_2013_published_version.pdf)

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

*Source: Direct from DECC Energy Statistics team.*

2012 calorific values of fuels to convert GJ to tonnes are available at:

<https://www.gov.uk/government/statistical-data-sets/dukes-2012-calorific-values>

- Litres to tonnes  
526 litres biodiesel = 1 tonne oilseed rape  
95 litres bioethanol = 1 tonne sugar beet  
365 litres bioethanol = 1 tonne wheat grain (at 15% moisture)

*Source: Department for Transport commissioned research to estimate biofuel production costs. It estimated average yields from a wide range of sources.*

## 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 Directive<sup>5</sup> 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/publications/renewable-transport-fuel-obligation-statistics-obligation-period-4-2011-12-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.

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<sup>5</sup> 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 Directive<sup>6</sup> (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 2012 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 informatin on production capacity.

Results or 2010 can be found in DECC/Ricardo-AEA Ltd “RESTATS: UK Production of Biofuels for transport in 2010 – Abstract” at:

[https://restats.decc.gov.uk/cms/assets/Uploads/Results\\_2010/ABSTRACT-UKBiofuelsProduction2010v2.pdf](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](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](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>

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<sup>6</sup> 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>