



EXPERIMENTAL STATISTICS

Area of Crops Grown For Bioenergy in England and the UK : 2008-2011

Experimental statistics produced by Defra on the areas of oilseed rape, sugar beet, wheat, miscanthus, short rotation coppice (SRC) and straw crops grown in the UK for use as bioenergy were released on 24 January 2013 according to the arrangements approved by the UK Statistics Authority. 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 existing sources have been combined in order to derive crop area estimates. They should be viewed and used with caution as the reliability and completeness has 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 second 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 summer/autumn 2013, with the exact date being published on the website when it is confirmed (<http://www.defra.gov.uk/statistics/>).

Key results

- Approximately 109 thousand hectares or 1.8 percent of UK arable land planted in 2010 was grown for production of bioenergy during 2011.
- This is composed of 8 thousand hectares of oilseed rape, 14 thousand hectares of sugar beet and 75 thousand hectares of wheat used to produce just over 1.3 million tonnes of crop for biofuel production for the UK road transport market but includes other markets and/or exports in the case of bioethanol from wheat.
- A further 9 thousand hectares of miscanthus and 3 thousand hectares of short rotation coppice grown in England were used for bioenergy production. Approximately 40 thousand tonnes of miscanthus and 15 thousand tonnes of short rotation coppice were used in power stations for electricity generation in 2010/11.
- Around 200 thousand tonnes of straw (approximately 2% of typical production) was used as fuel in biomass power stations in England in 2010/11.

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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.

Defra statistical releases, including details of future publication dates, and can be viewed on the Defra website at <http://www.defra.gov.uk/statistics/foodfarm/>.

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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.

Table 1: UK land areas used for agriculture

Thousand hectares

	2008	2009	2010	2011
Total utilised agricultural area (UAA) ^(a)	17 703	17 325	17 234	17 173
UAA as a proportion of total UK area	73%	71%	71%	70%
Total arable area ^(b)	5 900	5 922	5 847	5 932
Wheat	2 080	1 775	1 939	1 969
- of which used for bioethanol	0	0	75	tbc
Barley	1 032	1 143	921	970
Oilseed rape	598	570	642	705
- of which used for biodiesel	15	18	8	tbc
Sugar beet	120	114	118	113
- of which used for bioethanol	7	9	14	tbc
Maize (fodder and grain)	153	163	164	164
Short rotation coppice (England only)	6	4	3	3
Miscanthus (England only)	7	9	9	8
Uncropped arable land ^(c)	194	244	174	156
Temporary grass under 5 years old	1 141	1 241	1 232	1 278
Permanent grassland (incl. sole right rough grazing)	10 395	9 996	9 980	9 858
UK area used for biofuel crops	22	27	97	tbc
UK area used for bioenergy crops	36	40	109	tbc
% of UK arable area used for bioenergy	0.6%	0.7%	1.8%	tbc

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

- : data not collected or not available

tbc: to be confirmed (bioethanol production/usage data for 2012 of the 2011 crop 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) Includes set-aside pre-2007.

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

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

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

Wales: www.wales.gov.uk/statistics

Northern Ireland: <http://www.dardni.gov.uk/index/news/press-releases-statistical/press-release-statistical-current.htm>

For further enquiries on this dataset, please contact: Farming Statistics, Department for Environment, Food and Rural Affairs. Tel: 01904 455332, email: 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) for 10% of final energy consumption in the transport sector to be supplied from renewable sources by 2020. However the Government has proposed to amend the target from 5% to around 4.7% for 2013/14 and subsequent years but this is subject to legislation and the parliamentary process (footnote to table on page 5 : https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/9295/rfo-2011-12-year-four-report-five.pdf). The use of biofuels also supports three Government objectives to reduce Greenhouse Gas (GHG) emissions, improve security of energy supply and rural development.

Key facts

Just over 1.3 million tonnes of UK grown crops were used for biofuel production supplied primarily to the UK road transport market in 2010/11, but also includes bioethanol from wheat supplied to other markets and/or exports. This equates to around 97 thousand hectares of crops (1.7% of the total UK arable area). It comprises 1% of the UK oilseed rape area, 11% of the sugar beet area and 4% of the UK wheat area in 2010.

In 2010/11 figures for biofuel production show a large increase (83%) from the 2009/10 estimate of 0.7 thousand tonnes on to 27 thousand tonnes but overall in 2010/11 this accounted for just 1.7 per cent of the UK total arable area. The main drivers behind this increase were a much larger volume of wheat used for bioethanol in 2010/11 (581 thousand tonnes compared to 3 thousand tonnes in 2009/10) following the opening of the first bioethanol plant in the UK. The increased use of wheat was slightly counteracted by a 54% decrease in the tonnage of oilseed rape used for biodiesel (28 thousand tonnes compared to 60 thousand tonnes in 2009/10).

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 as at the 1 June each year. In the past, attempts have been made to ask farmers to report separately the area of crops grown for different purposes eg 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. It can be used more reliably for crops where there is one primary end use.

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 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 are given below with more detailed information given in Annex B.

1.1 Renewable Transport Fuels Obligation data collected by the Department for Transport.

The purpose is to collect 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. This provides information on the volume of biofuel supplied to the UK road transport market produced from UK grown oilseed rape, sugar beet and wheat. By applying relevant conversion factors, it is possible to derive the equivalent UK crop tonnages used and UK crop areas.

Data are supplied by obligated companies 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. 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.

1.2 Liquid Biofuels Survey data collected by the Department of Energy and Climate Change. 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 percent of biofuel from UK sources. It does not report a detailed breakdown of information by the type or origin of the feedstock used. However it is useful to compare the data from this survey with that reported under the RTFO as described in Section 1.1.

1.2 UK grown crops used for the production biofuels

Table 2 summarises the UK sourced biofuels reported under the RTFO (i.e. the biofuels supplied to the UK road transport market sourced from UK feedstocks). Crops and by-products have both been included to show how the type of feedstock has changed each year.

Table 2: Volume of UK sourced biofuels supplied to the UK road transport market for 2008/9 to 2010/11, split by crop type and by-products (years relate to April – March)

Fuel type	Quantity of UK sourced biofuels used in the UK road transport market (million litres or kg ^(a))			% change 2009-10 to 2010-11
	2008-09	2009-10	2010-11	
Biodiesel of which from:	67.3	101.5	142.5	40
Oilseed rape	26.3	31.6	14.5	-54
Tallow (by-product)	5.2	40.0	21.6	-46
Used cooking oil (by-product)	35.9	29.8	106.4	257
Bioethanol of which:	41.4	63.9	188.4	195
Sugar beet	41.4	63.0	68.5	9
Wheat	0.0	0.9	119.9	12619
Biogas (MSW ^(b))	0.4	0.2	0.4	119
Total UK sourced biofuel	109.1	165.6	331.3	100
UK sourced biofuels as a proportion of total biofuels used in UK road transport	9%	11%	22%	

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

(a) Biodiesel and bioethanol volumes are reported in litres and biogas volumes are reported in kilograms.

(b) MSW= Municipal Solid Waste.

The decrease in volume of home grown oilseed rape used in 2010/11 and the large increase seen in the volumes of used cooking oil may be explained by the 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 to equal 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 very large increase in wheat usage in 2010/11 was due to the opening of a large, new bioethanol plant in the UK which has 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 then closed temporarily in May 2011 due to market conditions. The plant restarted production in autumn 2012 with a second plant expected to begin production early in 2013.

The tables below 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. Additional account has been taken of UK wheat which has been used to produce bioethanol for markets other than UK road transport through reference to the DECC Liquid Biofuels Survey. The summary table is followed by detailed information for individual crops.

Table 3: Total UK crop areas (oilseed rape, sugar beet and wheat) used for biofuels (biodiesel and bioethanol) 2008-2011

All UK crops used as biofuels (RFTO year: April n-1 to March n)	Total volume of biofuels from UK grown crops (million litres)	Tonnage of crop implied (thousand tonnes) ^(a)	Area implied (thousand ha) and % of UK total arable area ^(b)
Year 1: April 2008 – March 2009	67.6	485	22.0 (0.4%)
Year 2: April 2009 – March 2010	95.5	726	27.0 (0.5%)
Year 3: April 2010 – March 2011 ^(c)	294.7	1 329	96.6 (1.7%)

(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 June in year n-1. Source : June Surveys of Agriculture, available at : <http://www.defra.gov.uk/statistics/foodfarm/landuselivestock/farmstats/>

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

1.2.1 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 so this would lead to an element of under-recording. However it is not possible to quantify this potential under recording because HMRC trade data and DECC results from the Liquid Biofuels survey do not differentiate between the different biodiesel feedstocks.

Table 4: UK oilseed rape areas used for biodiesel 2008-2011

Oilseed rape (RFTO year: April n-1 to March n)	Volume of biodiesel (million litres)		Tonnage of crop implied (thousand tonnes) ^(b)	OSR yield (t/ha) ^{(c)(d)}	Area implied (thousand ha) and % of UK total OSR area ^(d)
	UK grown crop	Of which on previously cropped land ^(a)			
Year 1: April 2008 – March 2009	26.3	14.5	50	3.3	15.1 (3%)
Year 2: April 2009 – March 2010	31.6	21.7	60	3.4	17.7 (3%)
Year 3: April 2010 – March 2011 ^(e)	14.5	5.1	28	3.5	7.9 (1%)

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

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

(c) Source: Defra annual Oilseed Rape Production Survey. UK yield at year n-1 <http://www.defra.gov.uk/statistics/foodfarm/food/cereals/cerealsoilseed/>.

(d) Source: Defra June Survey of Agriculture. UK area at year n-1 <http://www.defra.gov.uk/statistics/foodfarm/landuselivestock/junesurvey/>.

1.2.2 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. For 2008/9, 2009/10, and 2010/11 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, but were lower than usual in 2010 due to adverse weather conditions where frosts in January followed mild weather, causing the beet to rot in the ground leading to major losses. Generally yields have been increasing so the decrease in 2010 is an exception.

Table 5: UK sugar beet areas used for bioethanol 2008-2011

Sugar beet (RFTO year: April n-1 to March n)	Volume of bioethanol (million litres) ^(a)	Tonnage of crop implied (thousand tonnes) ^(b)	Sugar beet yield (t/ha) ^{(c)(d)}	Area implied (thousand ha) and % of UK total sugar beet area ^(d)
Year 1: April 2008 – March 2009	41.4	435	64	6.8 (6%)
Year 2: April 2009 – March 2010	63.0	663	74	9.0 (8%)
Year 3: April 2010 – March 2011	68.5	721	54	13.4 (11%)

(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. <http://www.defra.gov.uk/statistics/foodfarm/cross-cutting/auk/>

(d) Source: June Survey of Agriculture. UK area at year n-1. <http://www.defra.gov.uk/statistics/foodfarm/landuselivestock/junesurvey/>

1.2.3 Wheat (for bioethanol)

As with oilseed rape, any UK grown wheat locally processed into bioethanol then exported (and not re-imported) is not included in the RTFO figures. However for wheat, it is possible to derive an estimate of the amount of bioethanol locally produced, then used in other markets/exported by comparing the RTFO figures to the results from the DECC Liquid Biofuels survey, which is described in Section 1.1 and Annex B. In 2010 it was reported that around 52 per cent of the UK bioethanol produced from UK wheat, went into markets other than the UK road transport market.

Table 6: Estimated 2010 UK wheat area used for producing bioethanol which is used for markets other than UK road transport and/or exported

Data source	Bioethanol usage	Million litres	Area implied (thousand 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 used in other markets and/or exported from UK (derived from figures above) ^(a)	92	32.7

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

Using this information, Table 7 shows the RTFO figures converted into crop areas, along with this extra estimate of bioethanol in 2010 which was used in markets other than UK road fuel and/or exported.

Table 7: UK wheat areas used to produce bioethanol 2008-2011

Wheat (RTFO year: April n-1 to March n)	Volume of bioethanol (million litres) ^(a)	Tonnage of crop implied (thousand tonnes) ^(b)	Wheat yield (t/ha) ^{(c)(d)}	Area implied (thousand ha) and % of UK total wheat area ^(d)
Year 1: April 2008 – March 2009	0	0	8.3	0
Year 2: April 2009 – March 2010	0.9	3	7.9	0.3 (0%)
Year 3: April 2010 – March 2011	212	581	7.7	75.4 (4%)
total				
UK used (RTFO figures)	120	329		42.7
Other markets/exported (derived figures)	92	252		32.7

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

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

(c) Source: Defra annual Cereal Production Survey. UK yield at year n-1.

<http://www.defra.gov.uk/statistics/foodfarm/food/cereals/cerealsoilseed/>

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

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

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

The RTFO Annual Report for Year 2 (2009/2010) included area estimates for all countries supplying biofuels from crops into the UK (see pages 47-51 of the report). These are replicated in Table 8 below.

This table gives different area estimates from those presented in Tables 3-7 above because the volumes used in the RTFO calculations were adjusted to include 'unknown' country and feedstock data. 14% of the biofuel supplied to the UK came from an 'unknown' origin and this volume has been distributed across the 'knowns' in proportion to the known volumes.

Whilst this extra allocation of biofuel volume from 'unknown' origins causes the vast majority of the difference, the yields in the RTFO report also differ slightly from those presented in this Defra release. The yield figures used in the RTFO report are taken as the average of the 2000-2005 oilseed rape and wheat yields from FAO Statistics and from the John Nix Farm Management pocketbook 2006 for sugar beet yields. The yields in this Defra report are based on the Defra official yield estimates for 2009, making them comparable to other Defra published official agricultural statistics.

Table 8: RTFO estimated global land areas used for UK biofuels 2009-2010 ^{(a)(b)}

	Feedstock	Country of origin	Adjusted volume of biofuel supplied in UK (million litres)	Estimated land area to supply biofuel (thousand ha)
Biodiesel	Oilseed rape	France	48	32.9
		Germany	133	84.4
		Ukraine	11	20.5
		UK ^(c)	41 (32)	29.7 (17.7)
		USA	11	15.8
	Palm	Indonesia	32	10.6
		Malaysia	73	22.4
Soy	Argentina	382	829	
	USA	124	262	
Bioethanol	Corn	France	14	3.9
	Sugar beet	France	13	2.4
		UK ^(c)	65 (63)	11.8 (9.0)
	Sugar cane	Brazil	317	55.4
	Wheat	Belgium	6	2.3
		France	31	11.9
Total			1 301	1 395
% from UK feedstocks			8%	3%

(a) A minimum volume of 5 million litres has been used for inclusion in this table.

(b) 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).

(c) 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.

Source: Table 3.6 from RTFO report for Year 2 (2009/10) Page 50

http://webarchive.nationalarchives.gov.uk/20110407094507/http://www.renewablefuelsagency.gov.uk/sites/rfa/files/Year_Two_RTFO_v2.pdf

RTFO yield information: 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 three 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 of which are UK sourced. The years run on a financial year basis ie April to March.

Table 9: RTFO Year 3 (2010-11) 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 2010-11	Total volume of biofuels supplied to UK 2010-11 ^(b)	Total volume of road transport fuels supplied to UK 2010-11		
Biodiesel of which:	142.5	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>	106.6				
Bioethanol of which:	188.4	618	19 876	30%	3.0%
<i>Sugar beet</i>	68.5				
<i>Wheat</i>	119.9				
Biogas (MSW ^(c))	0.4	0.4		100%	
Total biofuel	331.3	1 517	44 834	22%	3.3%
Annual target					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).

Table 10: RTFO Year 2 (2009-10) 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 2009-10	Total volume of biofuels supplied to UK 2009-10 ^(b)	Total volume of road transport fuels supplied to UK 2009-10		
Biodiesel of which:	101.5	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				
Bioethanol of which:	63.9	455	21 216	14%	2.1%
<i>Sugar beet</i>	63.0				
<i>Wheat</i>	0.9				
Biogas (MSW ^(c))	0.2	0.2		100%	
Total biofuel	165.6	1 568	45 587	11%	3.3%
Annual target					3.3%

Source:

http://webarchive.nationalarchives.gov.uk/20110407094507/http://www.renewablefuelsagency.gov.uk/sites/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 11: RTFO Year 1 (2008-09) 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 2008-09	Total volume of biofuels supplied to UK 2008-09 ^(b)		
Biodiesel of which:	67.3	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			
Bioethanol of which:	41.4	225	18%	
<i>Sugar beet</i>	41.4			
<i>Wheat</i>	0.0			
Biogas (MSW ^(c))	0.4	0.4	100%	
Total biofuel	109.1	1 284	9%	2.7% ^(d)
Annual target				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.

1.4 Digest of UK Energy Statistics (DUKES)

The Department for Energy and Climate Change (DECC) produce the “DUKES” annual publication. Data are obtained from figures published by HM Revenue and Customs (HMRC) derived from fuel taxation statistics.

DUKES data (from HMRC) includes:

- All biofuels sold commercially into the UK road transport market.
- Separate estimates for biofuels produced in the UK at the aggregate level. Note however, that these also include biofuels which have been exported.

DUKES data excludes:

- Very small scale production (for personal use).

Table 12: Biofuels used as transport fuels in the UK in tonnes of oil equivalent ^(a)

Thousand tonnes of oil equivalent (toe)

	2006	2007	2008	2009	2010
Renewable sources used as transport fuels					
as Bioethanol	53	86	116	180	355
as Biodiesel	134	276	728	858	859
Total biofuels used	188	362	845	1 038	1 214

Source: Extract from Table 7.6 in Chapter 7 (Renewable Energy Statistics) of the DECC Digest of UK Energy Statistics (DUKES) 2011

<http://www.decc.gov.uk/en/content/cms/statistics/publications/dukes/dukes.aspx>

(a) Figures include biofuels from all feedstocks, not just from crops. See Annex A for detailed definitions of the categories used in this table.

The following table converts these volumes into litres and compares these to the volumes which are produced in the UK as reported from the DECC "Liquid Biofuels Survey"- see Annex B for more details of this survey.

Table 13: Biofuels used as transport fuels in the UK compared to the volumes produced in the UK ^(a)

million litres

	2006	2007	2008	2009	2010	% change 09-10
Bioethanol used in UK transport fuel of which:	95	152	206	320	631	97
UK produced ^(b)	-	-	70	76	281	270
% UK produced	-	-	34%	24%	45%	-
Biodiesel used in UK transport fuel of which:	164	336	886	1 044	1 045	0
UK produced ^(b)	-	-	320	223	175	-22
% UK produced	-	-	36%	21%	17%	-
Total biofuels used in UK transport fuel of which:	258	488	1 093	1 364	1 676	23
UK produced ^(b)	-	-	390	299	456	53
% UK produced	-	-	36%	22%	27%	-

Source: Based on figures in table above from DUKES 2011

(a) Conversion: 1 toe=41.868 Gigajoules (GJ). Bioethanol= 23.6 MJ per litre. Biodiesel= 34.4 MJ per litre.

Source: DECC (in common with the International Energy Agency and with the Statistical Office of the European Communities (SOEC))

(b) Includes subsequent exports.

The trend in UK bioethanol production mirrors the trends seen in bioethanol usage with a large increase in 2010. UK biodiesel production has been falling steadily over the years, in response to small producers going out of business and cheaper imports being available. This decrease in home production is showing an opposite trend to the amount of biodiesel being used in UK transport which has been steadily increasing over time. It is possible that UK grown oilseed rape is being exported for processing into biodiesel and use outside the UK but this is not captured by existing survey sources.

2 Plant Biomass: Miscanthus and Short Rotation Coppice (SRC)

Miscanthus and 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 short rotation coppice (SRC) in 2011.
- Approximately 15 thousand tonnes of SRC were used in UK power stations for electricity in 2010/11. This equates to almost all of the SRC produced in England in 2010, based on low end assumptions of yields.
- Approximately 40 thousand tonnes of miscanthus were used in UK power stations for electricity in 2010/11. This is less than half of all the miscanthus produced in England in 2010, based on low end assumptions of yields. There are other outlets for using miscanthus such as livestock bedding and, in small scale Combined Heat and Power (CHP) plants or directly on farms or domestic premises for heating but the volumes used are not available.

2.1 Miscanthus areas

The official area estimates of miscanthus grown in England are available from the Defra June Survey of Agriculture from 2008 when this was first included in the survey form to farmers (see Table 14). 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 only when a census survey was carried out; estimates for other year are not sufficiently robust given the sample size and associated confidence intervals. Regional variations do not give a consistent picture of trends. Miscanthus is grown on around 0.2% of the total arable area in England.

Table 14: Total planted area of Miscanthus in England ^(a)

	Hectares			
English region	2008	2009	2010	2011
North East	-	-	0	-
North West	-	-	70	-
Yorkshire and Humber	-	-	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
<i>95% confidence interval</i>	<i>+/- 1 097</i>	<i>+/- 2 348</i>	<i>+/- 950</i>	<i>+/- 807</i>
Number of growers	335	394	404	398

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) 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://www.defra.gov.uk/statistics/foodfarm/landuselivestock/nonfoodcrops/>

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>.

These tables show that the area claimed under subsidies (7,874 hectares) is similar to the complete 2011 area reported from the Defra June Survey (8,075 hectares), suggesting that the vast majority of Miscanthus is being grown within the subsidy payment scheme.

Table 15: Area of Miscanthus new plantings under the Energy Crops Scheme: England

English region	ECS1: 2000-2006/7 area ^(a)	ECS2: 2007-2011 area ^{(b)(c)}				ECS2: 2007-2011 total area ^(c)	Total area claimed under ECS 2000-2011
		2008	2009	2010	2011		
North East	0	0	0	0	0	0	0
North West	63	0	0	0	0	0	63
Yorkshire and Humber	1 843	32	43	46	96	216	2 059
East Midlands	1 890	45	100	91	97	333	2 223
West Midlands	859	24	90	80	180	374	1 233
East of England	381	0	0	34	59	93	473
South East	305	9	36	42	7	95	400
South West	1 036	22	211	114	40	387	1 423
England	6 376	130	481	407	480	1 498	7 874

(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 taken from Natural England website in January 2012.

(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 31 January 2012.

(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 apply for both payments. Therefore, the EAPS data double counts the area already measured under ECS and is thus not considered here as additional area. This theory is also supported by the fact that the ECS area closely compares to the June Survey area which is collected independently from any subsidy information.

Table 16: Establishment grant payments for Miscanthus under the Energy Crops Scheme

Thousand £

English region	ECS1: 2000-2006 ^(a)	ECS2: 2007-2011 ^{(b)(c)}	Total grant paid to date 2000-2011
North East	0	0	0
North West	58	0	58
Yorkshire and Humber	1 695	180	1 874
East Midlands	1 738	221	1 959
West Midlands	790	286	1 076
East of England	347	78	425
South East	281	92	373
South West	953	260	1 213
England	5 861	1 116	6 977

Source: On-going scheme statistics on the Natural England ECS website (click on "Scheme statistics")

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

(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 taken from Natural England website in January 2012.

(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 as at 31 January 2012.

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

2.2 Size of farms growing miscanthus

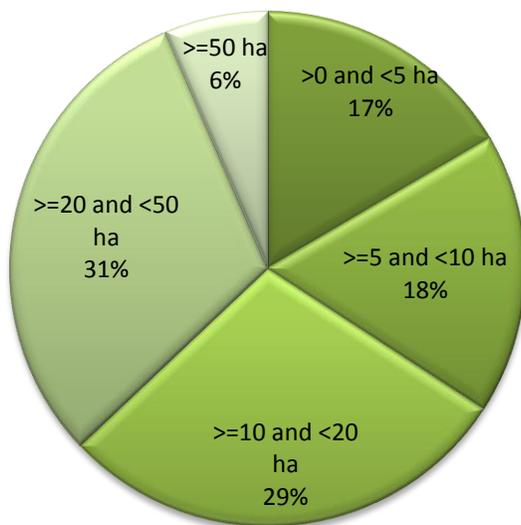
The Defra Census of Agriculture 2010 estimates there are around 400 miscanthus growers in England (see Table 17). The areas of miscanthus on these farms by size band are shown in Table 17 and Figure 1. More than one third (37%) of growers have between at least 20 hectares of miscanthus (Figure 1) and so are embarking on projects on quite a large scale. These farms account for almost three quarters (72%) of the total miscanthus area.

Table 17: 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
England	404	8 657	100	100

Source: Defra June Census of Agriculture and Horticulture 2010.

Figure 1: % of Miscanthus farms by area band: England 2010



2.3 Miscanthus yields/production

Much research has been done into miscanthus yields but as yet, no official estimates of achieved yields are available. Yields vary greatly depending on a number of factors. The number of years since planting has a great effect as the first year's growth is not worth harvesting. Yields then gradually improve to reach maturity over five years and the crop can continue to be harvested for 15-20 years. Other factors affecting yields are type of planting method, species, site conditions, as well as the standard variations of region, annual weather conditions etc.

Taking all these factors into consideration, 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 18 below 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 to give an indication of the scale of miscanthus production. 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 18: Miscanthus production estimates, based on upper and lower yield estimates (averaged across all factors affecting yield)

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

Source: Yield info taken from National Non-Food Crops Centre (NNFCC) Miscanthus fact sheet <http://www.nnfcc.co.uk/publications/nnfcc-crop-factsheet-miscanthus>. Industry yields based on direct conversations with growers and end users.

2.4 Miscanthus usage

Table 19 below shows the volume of UK produced miscanthus which was used in power stations in the UK in 2009/10 and 2010/2011. The main power stations using this crop were Drax (Yorkshire), Kingsnorth (Kent) and Ely (Cambridgeshire) (2010 only). 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 in the Renewables Obligation.

Table 19: Miscanthus usage in UK power stations 2009-10 and 2010-11^(a)

Biomass type and form	Volume used 2009-10 (tonnes)	Volume used 2010-11 (tonnes)
Miscanthus total ^(b) of which:	15 561	40 580
Pure Miscanthus	3 705	28 171
Miscanthus blend ^(c)	11 857	12 409

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)

(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 (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 increase in miscanthus usage in 2010 was caused by Ely power station increasing miscanthus usage, while reducing volumes of straw used. There is still a substantial difference between power station usage and potential production. This may in part be explained because the post-2009 plantings of almost 900 hectares (from the ECS data in Table 15 above) may not have reached productive maturity to be used in the power plants. This 900 hectares potentially equates to around 9,000 tonnes.

There are also other uses of miscanthus such as horse and livestock bedding, in small scale Combined Heat and Power (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 20 also provides the estimated numbers of growers in each year. Regional crop areas are provided for 2010 only when a census survey was carried out; estimates for other year are not sufficiently robust given the sample size and associated confidence intervals. Short rotation coppice (since 2009) represents less than 0.1% of the total arable area in England.

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

Hectares

English region	2008	2009	2010	2011
North East	-	-	350	-
North West	-	-	169	-
Yorkshire and Humber	-	-	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
<i>95% confidence interval</i>	<i>+/- 2 839</i>	<i>+/- 1 349</i>	<i>+/- 416</i>	<i>+/- 768</i>
Number of growers	373	381	251	228

Source: Defra June Survey of Agriculture and Horticulture

<http://www.defra.gov.uk/statistics/foodfarm/landuselivestock/junesurvey/>. In house data analysis to produce regional figures and numbers of growers.

Since 2009, the picture has been relatively stable, though regional variations do not give a consistent picture and may be fluctuating because of the natural sampling variation (indicated by the confidence intervals). It is suspected that the apparent large fall in area between 2008 and 2009 as 2008 is due to reduced data robustness in 2008, the first year of this data collection.

A secondary source of area statistics is available from the Energy Crops Scheme (ECS) subsidy data. See the miscanthus Section 2.1 above for more details. A summary of the newly planted areas claimed under the two rounds of this scheme are shown below in Tables 21 and 22, along with the total amounts paid under these schemes.

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

Hectares

English region	ECS1: 2000-2006/7 area ^(a)	ECS2: 2007-2011 area ^{(b)(c)}				ECS2: 2007-2011 total area ^(c)	Total area claimed under ECS 2000-2011
		2008	2009	2010	2011		
North East	228	0	0	0	0	0	228
North West	125	0	0	0	0	0	125
Yorkshire and Humber	464	11	3	29	46	89	553
East Midlands	609	49	91	91	34	264	874
West Midlands	27	0	0	0	0	0	27
East of England	76	0	13	6	21	40	116
South East	257	3	15	0	0	18	274
South West	31	3	5	2	0	11	41
England	1 815	67	127	128	100	422	2 237

As for miscanthus, these data shows that the total area of new plantings claimed under subsidies (2,237 hectares) is similar to the complete area reported from the Defra June Survey 2011 (2,720 hectares), suggesting that the vast majority of SRC is being grown within the subsidy payment scheme.

Table 22: Establishment grant payments for SRC under the Energy Crops Scheme

Thousand £

English region	ECS1: 2000-2006 ^(a)	ECS2: 2007-2011 ^{(b)(c)}	Total grant paid to date 2000-2011
North East	232	0	232
North West	123	0	123
Yorkshire and Humber	470	70	540
East Midlands	597	145	741
West Midlands	28	0	28
East of England	76	38	114
South East	257	11	268
South West	31	6	37
England	1 812	270	2 081

Source: On-going scheme statistics on the Natural England ECS website (click on "Scheme statistics")

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

(a) ECS1: 2000-2006/7: Summary of area planted and establishment payments made for the duration of the scheme. Includes agreements accepted for 2007. Figures taken from Natural England website in January 2012.

(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 as at 31 January 2012

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

2.6 Size of farms growing Short Rotation Coppice

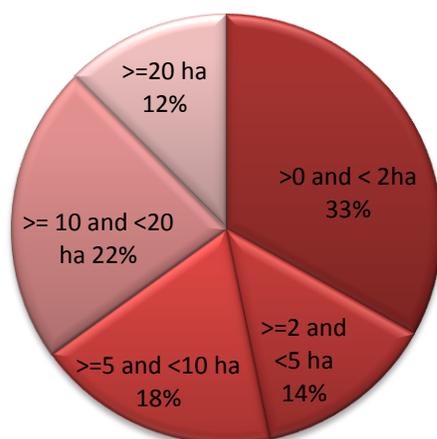
The Defra Census of Agriculture 2010 estimates there are around 250 Short Rotation Coppice (SRC) growers in England (see Table 23). A small numbers growers produce the majority of SRC - 12% of SRC growers account for half the national area between them. A third of SRC growers (accounting for just 47 hectares) have very small areas (less than 2ha each). The minimum area required to claim ECS subsidies is 3ha so it is unlikely that these growers would be claiming subsidy payments to assist with crop establishment.

Table 23: 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
England	251	2 591	100	100

Source: Defra June Census of Agriculture and Horticulture 2010.

Figure 2: % of Short Rotation Coppice farms by area band: England 2010



2.7 Short Rotation Coppice yields/production

Much research has been done into SRC yields but as yet, no official estimates of achieved yields are available. SRC is only 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.

Table 24 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 to give an indication of the scale of SRC production. These figures should be treated as broad estimates, rather than definitive figures as there is much uncertainty behind the yield estimates.

Table 24: Short Rotation Coppice production estimates, based on upper and lower yield estimates (averaged across all factors affecting yield)

Year	Area (ha)	Yield (odt/ha) ^(a)	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

(a) National Non-Food Crops Centre SRC fact sheet <http://www.nnfcc.co.uk/publications/nnfcc-crop-factsheet-short-rotation-coppice-src-willow>, Natural England guidance to applicants of ECS http://www.naturalengland.org.uk/Images/short-rotation-coppice_tcm6-4262.pdf, Forestry Commission guidance http://www.biomassenergycentre.org.uk/portal/page?_pageid=75,18113&_dad=portal&_schema=PORTAL

Industry experts at the National Non Food Crops Centre (NNFCC) estimate that SRC yields vary between 25 to 35 oven dried tonnes/ha, equating to an annual yield average of 9.4 odt/ha/yr (taking the average 3 yearly harvest period into account). Natural England and the Forestry Commission suggest yields of willow SRC at first harvest are in the range 7– 12 odt/ha/yr and the Forestry Commission suggest a likely average yield of poplar in the region of 8 odt/ha/yr. Other industry experts suggest that yields are much lower than these and may be in the region of 6 odt/ha/yr.

2.8 Short Rotation Coppice usage

Table 25 below shows the volume of UK produced SRC Willow which was used in power stations in the UK between 2009/10 and 2010/2011. These power stations were Cottam (Nottinghamshire), Drax (Yorkshire), Steven's Croft (Scotland) and "Wilton 10" SembCorp biomass power station (Teesside) (2009 only). These data are collated by Ofgem, as part of sustainability requirements in the Renewables Obligation.

Table 25: Short Rotation Coppice usage in UK power stations 2009-10 and 2010-11 ^(a)

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

(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)

The volumes recorded here are broadly similar to the lower end of production levels estimated in the previous table though, as with miscanthus, the 228ha of new plantings since 2009 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 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 26: Volume of plant biomass used in the UK to generate heat and electricity: 2000 to 2010
 Thousand tonnes of oil equivalent

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

	2006	2007	2008	2009	2010	% change 2009-10
Total plant biomass used for heat/electricity of which:	1 055	888	906	1 163	1 493	28
Used to generate electricity	952	779	718	960	1 234	29
Co-firing with fossil fuels	829	641	529	592	822	39
Plant Biomass ^(a)	123	138	189	367	412	12
Used to generate heat (plant biomass only) ^(b)	103	109	188	203	259	28
Percentage used for electricity	90%	88%	79%	83%	83%	

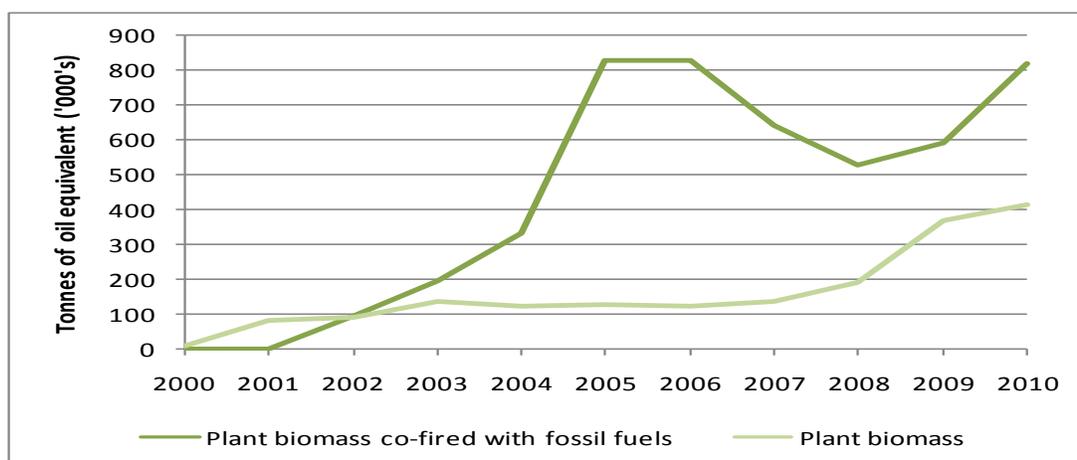
Source: Table 7.6 from Chapter 7 of the DECC Digest of UK Energy Statistics (DUKES) 2011
http://www.decc.gov.uk/en/content/cms/statistics/energy_stats/source/renewables/renewables.aspx

(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 3 below 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, rising to a peak in 2005 and 2006, followed by a decrease then an increase again by 2010 to the same high levels seen in the mid-2000's.

Figure 3: Volume of plant biomass used for electricity: 2000 to 2010



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 200 thousand tonnes of straw (2% of total straw production) was used as fuel in biomass power stations in England in 2010/11.

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 across the UK administrations each year and the relevant areas are shown in Table 27 below.

Table 27: UK cereal areas at June each year

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

Source: June Survey of Agriculture. <http://www.defra.gov.uk/statistics/foodfarm/landuselivestock/junesurvey/>

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 28 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 28: UK estimates of cereal straw production based on typical straw yields

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

The 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, though 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 29: Estimates of cereal straw supply and demand in the UK

UK supply/demand	Thousand tonnes	% of cereal straw production	Implied cereal area (thousand ha) ^(a)
Cereal straw availability ^(b)	10 400		3 048
Cereal straw usage			
Animal bedding ^(b)	5 800	56%	1 700
Animal feed ^(b)	2 000	19%	586
Mushroom industry ^(c)	40	<0.1%	12
Power stations ^(d)	200	2%	59
Surplus cereal straw resource available in the UK for other markets	2 360	23%	692

(a) Area of wheat, barley and oats. Implied areas are calculated as the % of cereal straw production multiplied by the 2011 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 (2009-10): Ofgem Renewables Obligations dataset (2009-10 data):

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

Ofgem (2010-11): Ofgem Renewables Obligations dataset (2010-11 data):

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

This table 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.

3.2 GB regional availability and usage of straw

The Central Science Laboratory (CS, 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 table below and in the following map (broken down further to county level).

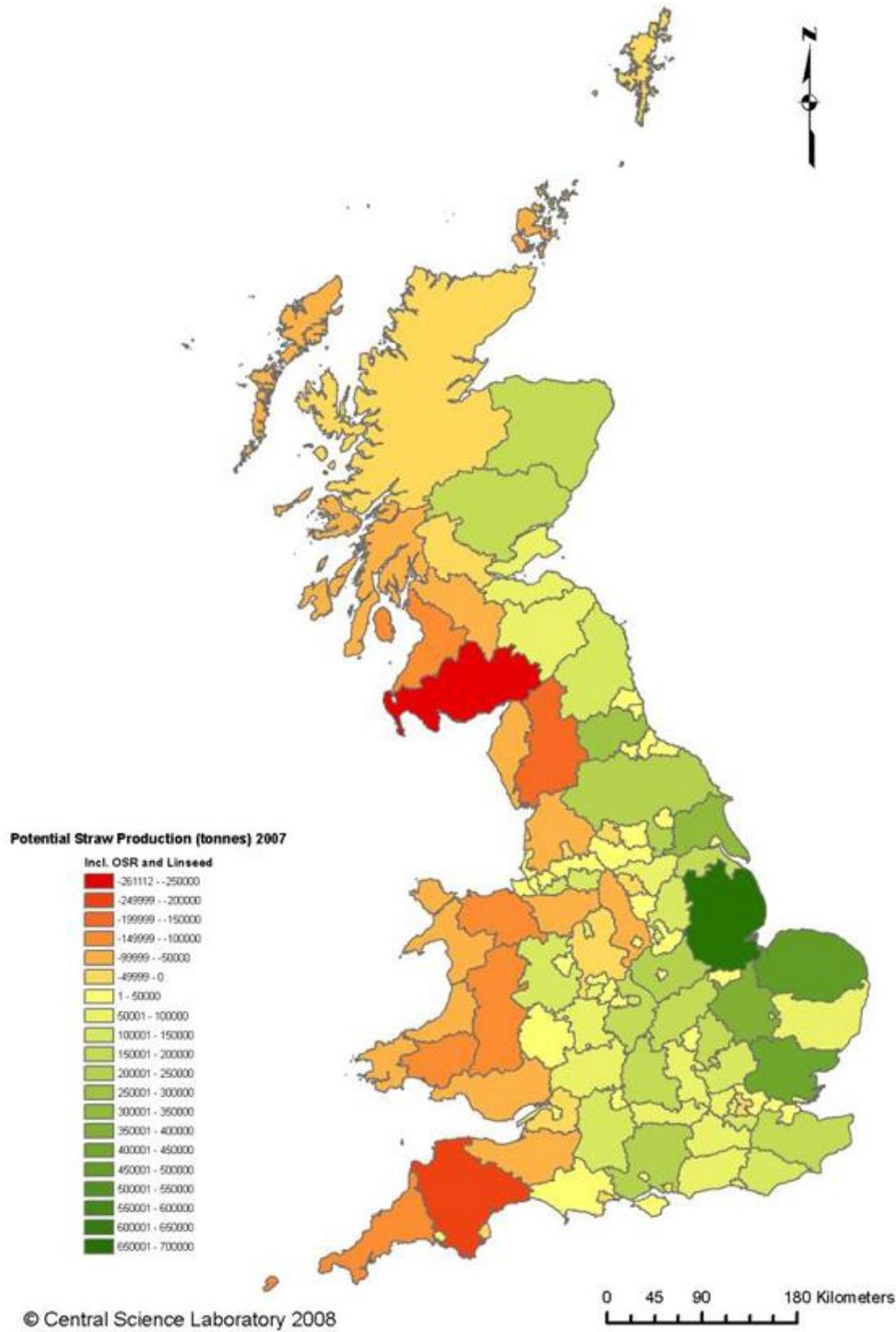
Table 30: Potential cereal and oilseeds straw availability by GB region after deduction of estimated requirements for livestock bedding

GB region	Straw balance (thousand tonnes)
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
England	6 506
North West Scotland	- 80
North East Scotland	162
South East Scotland	422
South West Scotland	- 537
Scotland total	- 33
Carmarthenshire	- 136
Ceredigion	- 72
North East Wales	- 105
North West Wales	- 94
Pembrokeshire	- 99
Powys	- 135
South Wales	- 63
Wales total	- 704
GB total	5 769

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 4 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 4: 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 31 below shows the volume of UK produced straw which was used in biomass power stations in England and Wales between 2009/10 and 2010/11. These data are collated by Ofgem, as part of sustainability requirements in the Renewables Obligation.

Table 31: Straw usage in English power stations 2009-10 and 2010-11 ^(a)

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

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)

(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 of this volume 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 32: 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	2013	240
Brigg, East Yorkshire	Construction in 2012	240
Tansterne CHP plant, Holderness, East Yorkshire	Construction 2013, operational in 2015	66
Tesco CHP plant, Goole, East Yorkshire	Planning granted 2011	43
Total		589

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=LMMRY5KBJ0NO00>

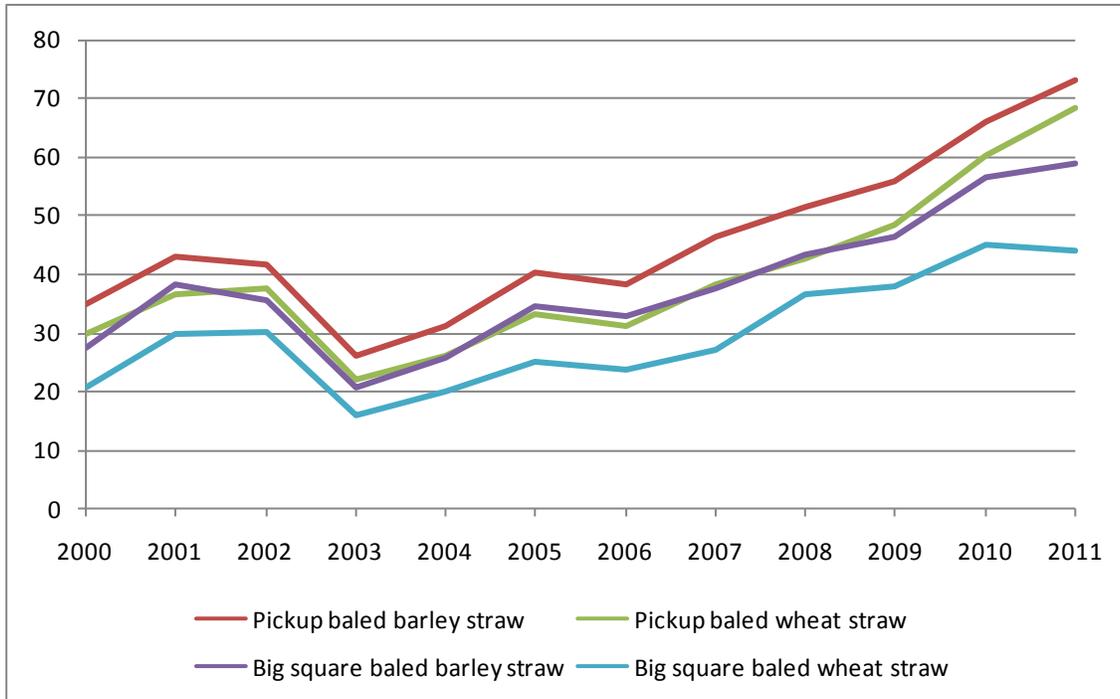
Tesco CHP plant (potential volumes of straw to be used) <http://www.nfccc.co.uk/tools/national-and-regional-supply-demand-balance-for-agricultural-straw-in-great-britain> (via <http://www.northwoods.org.uk/files/northwoods/StrawAvailabilityinGreatBritain.pdf>)

3.4 Straw prices

The chart below shows the 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.

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



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

Table 33: Annual average farm price of straw in England and Wales

£ per tonne

Year	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

Annex A: Glossary of terms and conversion factors

Definition of biodiesel and bioethanol (Source: Chapter 7, paragraph 7.81 of DUKES 2011)

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.

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 <http://www.decc.gov.uk/assets/decc/11/stats/publications/dukes/2303-dukes-2011-chapter-1-energy.pdf>

- MJ to litres

Bioethanol= 23.6 MJ per litre, Biodiesel= 34.4 MJ per litre. Source: Direct from DECC Energy Statistics team.

2010 calorific values of fuels to convert GJ to tonnes are available at

http://www.decc.gov.uk/en/content/cms/statistics/energy_stats/source/cv/cv.aspx

- 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.

bbvc

These data are 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) and verified year 3 (April 2010 to March 2011) data are all available on the DfT website at : <https://www.gov.uk/renewable-transport-fuels-obligation>. The verified year 4 data are expected to be available in February 2013. The verified data for 2010/11 are available at :

<http://assets.dft.gov.uk/statistics/releases/verified-rtfo-biofuel-statistics-2010-11/year-3-verified-report.pdf>. Historic verified data for 2008/09 and 2009/10 are available in Excel spreadsheets on the archived website at :

<http://www.official-documents.gov.uk/document/other/9780108508868/9780108508868.pdf> and

http://webarchive.nationalarchives.gov.uk/20110407094507/http://www.renewablefuelsagency.gov.uk/sites/rfa/files/Year_Two_RTFO_v2.pdf

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.

The RTFO data exclude:

- UK biofuel production which may subsequently be exported.
- Producers of less than 450,000 litres of fossil fuel per year who do not claim Renewable Transport Fuel Certificates (RTFCs). The RTFCs can potentially be sold to obligated companies that may then use them to meet their obligation. However it is not expected that there are many small producers excluded from the RTFO statistics.
- Biofuel producers who do not use any fossil fuels (i.e. only supply biofuels) and do not claim Renewable Transport Fuel Certificates (RTFCs). For the same reason as above, it is not expected that there are many of these excluded from the RTFO statistics.

B.2 DECC “Liquid Biofuels” Survey methodology

To estimate the volume of biofuels produced in the UK from 2010 onwards, the Oil & Gas Statistics Team in DECC carry out an annual “Liquid biofuels survey”. Neither HMRC or RTFO figures can be used for this purpose since they include both UK produced fuels and imports. Between 2006-2009 the survey was carried out by AEA on behalf of DECC Statistics. The production companies are contacted directly in combination with a survey of UK biofuels production capacity that is required by the EU (Reg. 833/2010). The data include estimates for very small scale production (for personal use), though this makes a very small contribution to the totals.

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

Results from 2010 are on Page 3 in DECC/AEA Technology plc “RESTATS: UK Production of Biofuels for transport in 2010 – Abstract”

https://restats.decc.gov.uk/cms/assets/Uploads/Results_2010/ABSTRACT-UKBiofuelsProduction2010v2.pdf

Further details on the Liquid Biofuels survey are available on page 5 at

<http://www.decc.gov.uk/assets/decc/statistics/source/renewables/60-renewable-statistics-methodology.pdf>