UPDATE ON BIOFUELS POSITION PAPER

Introduction

1. The Committee previously considered this subject during 2007, resulting in the publication of its position paper on 30 April 2008. At its 3 March and 3 June 2010 meetings, the Committee received presentations on biofuels. Following these presentations, the Committee agreed that its position paper should be revised and adapted in line with emerging developments.

2. There have been significant developments in the biofuels industry since 2008 and as a result there are some changes to the section headings.

3. The Committee was sent an inter-sessional paper ACAF/11/06 on the 27 April 2011 and asked to provide comments. The Secretariat has updated the paper based on the comments received and the below position paper has now been agreed by ACAF.

Biofuel Legislation, Targets and Use

4. On 23 April 2009, European Parliament and Council Directive 2009/28/EC on the promotion of the use of energy from renewable sources was published (the Renewable Energy Directive). From 1 January 2012, this amends and repeals Directives 2001/77/EC and 2003/30/EC on the promotion of the use of biofuels and other renewable fuels for transport (the Biofuels Directive). Council Directive 2009/28/EC came into force at the end of June 2009, with a transposition date of 5 December 2010, and sets targets for all Member States to source 20% of their energy from renewable sources by 2020, with the transport sector sourcing 10% of its energy from renewable sources. The Directive also requires that only sustainable biofuels are used, which generate a clear greenhouse gas saving with no negative impact on biodiversity and land use. On the 10 March 2011 the Department for Transport began a public consultation on the implementation of transport elements of the Renewable Energy Directive. The consultation ended on 2 June 2011.

5. Other legal drivers that impact on biofuels include:

- the Climate Change Act 2008: this came into force in January 2009 and recognises that the Renewable Fuels Agency (RFA)[1] has a role in encouraging transport fuel suppliers to supply 'good' biofuels; and
- the Biodiesel Duty (Biodiesel Produced from Waste Cooking Oil) (Relief) Regulations 2010: this SI came into force on 1 April 2010 and expires on 31 March 2012. It provides for a tax relief scheme for biodiesel produced from waste cooking oil.
- the Fuel Quality Directive (2009/30/EC of 23 April 2009) by which fuel suppliers must deliver a 6% reduction in greenhouse gas emissions by 2020. This target is likely to be achieved largely through the use of biofuels, which must comply with the same sustainability characteristics as those set out in the Renewable Energy Directive.

UK Government policy leads

6. The Department for Transport (DfT) has primary responsibility for biofuels policy. However, biofuels is a wide-ranging topic and DfT liaises closely with other government departments and consults with a number of these during policy development, including:
    - the Department of Energy and Climate Change (DECC);
    - HM Treasury;
    - Defra;
    - the Department for Business Innovation and Skills (BIS);
    - the Foreign and Commonwealth Office (FCO); and
    - the Department for International Development (DFID).

7. Policies on renewable energy (including biofuels) have yet to be finalised following the change of Government in May 2010.

Renewable Transport Fuel Obligation (RTFO)

8. In its 2008/09 report on the Renewable Transport Fuel Obligation (RTFO), the Renewable Fuels Agency (RFA) confirmed that 2.7% of the UK's total road

[1] On Thursday, 31 March 2011, the Renewable Fuels Agency (RFA) was dissolved as part of a wider review of arms-length government bodies. Its duties were transferred to the Department for Transport.

transport fuel supply was biofuel (this exceeded the Government target of 2.5%, and was more than twice the supply of biofuel in 2007/08).

9. The report noted that the UK biofuels market was yet to have a large impact on agriculture in the UK. Biofuels from UK grown crops account for 9% of the total supplied under the RTFO in 2008/09; the UK biofuel industry used about 4% of the annual UK oilseed rape crop and approximately 8% of the sugar beet crop. Biofuel crops for the RTFO used an estimated 33,000 hectares (ha) of land in the UK. The report also estimated that about 1.3 million ha of land outside the UK was used for crops producing biofuel feedstocks for the UK market, primarily soya beans in the USA and Argentina, sugar cane from Brazil and oilseed rape in Germany.

10. The table below gives the targets for the RTFO for the first three years.

Year:	**2008/09**	**2009/10**	**2010/11**
Biofuel use by volume	2.5%*	3.25%	3.5%
Data capture	50%	70%	90%

Table 1. RTFO targets for 2008-2011.

** the intended target of 2.5% biofuel in the total road transport fuel supply in 2008/09 was compromised by the identification of a drafting discrepancy in the RTFO Order.*

11. Provisional data for the second RTFO report for 2009-10 indicate that almost 1.6 billion litres of biofuel were produced. This accounts for 3.33% of the UK's road transport fuel, exceeding the Government's target of 3.25%.

Current Status of the UK Biofuel Industry

12. There are two types of biofuel production: bioethanol and biodiesel. Bioethanol production uses biomass and / or the biodegradable fraction of waste to produce ethanol, whereas biodiesel uses vegetable or animal oil to produce a diesel type fuel by transesterification.

13. The infrastructure of the UK biofuel industry has changed significantly since 2008. There were four biodiesel plants in operation in 2008; three plants have now been decommissioned, and the remaining plant is expected to produce little to no co-product for animal feed use (Ensus, 2010).

14. The UK has two commissioned bioethanol plants and two plants under development. Of the two active plants, one uses wheat feedstock and the other uses sugar beet feedstock. The plants under development in 2010 are shown below, although at the time of writing, the plant in Wilton was temporarily closed.

Bioethanol plant location	**Feedstock**	**Amount of feedstock used (million tonnes/year)**	**Bioethanol produced (million litres/year)**	**Animal feed produced (million tonnes / year)**
Wissington, Norfolk	Sugar beet	0.65	77	0.5
Wilton, Cleveland *	Wheat	> 1	400	0.35
Saltend, Hull**	Wheat	1.1	420	> 0.5
Immingham, Lincs**	Wheat	0.5	Unknown	Unknown

Table 2. Table showing bioethanol plants that are active or under development in the UK, their location and possible production rates. (Data from Ensus, 2010, Feed Compounder, Nov 2010 and Renewable Energy Association).

** temporarily closed.*
*** under development*

Feedstocks, co-products and biofuel research and development

15. Co-products from first generation biofuels continue to be the only significant input to the feed industry, despite significant research and development in the use of alternative feedstocks (raw products used in the production of biofuels). The previous ACAF position paper stated that the use of second or third generation biofuels could become viable in the UK in the future. Biofuel production from second generation biomass feedstocks has proved to be difficult and it is expected that UK production will be negligible for the near future (Ensus, 2010). Research has continued on carbon neutral third generation biofuels based on algae and bacteria, that are able to break down cellulose. However, there is increasing focus on the use of genetic modification (GM) to improve the capture and storage of energy. GM is used to direct cell metabolism to confer advantageous traits such as creating or promoting the synthesis of valuable substrates, to accelerating the synthesis of an end-product (Carere et al, 2008).

16. Due to a change in animal by-product (ABP) legislation, there is more scope for the use of ABPs in biodiesel production. EU Regulation 1774/2002 has recently been superseded by Regulation 1069/2009, which allows a variety of fats and oils

produced from category 1, 2 or 3 ABPs (animal fat or used cooking oil) to be used in biofuel production, also known as FAME production. The legislation only allows category 3 tallow to be used where the co-products (glycerol and mineral salts) are intended for animal feed (FABRA[2], 2010).

17. Glycerol derived from biodiesel production was used as animal feed in 2008. Animal by-products (ABPs) can be processed to produce ingredients or products for biofuel production and biodiesel in particular (FABRA, 2010). In December 2010, EFSA published an Opinion on the use of glycerine as a co-product from biodiesel production from Category 1 animal by-products (ABP) and vegetable oils. EFSA stated that inclusion rates of glycerol at levels of up to 15% of the diet of ruminants and 10% in non-ruminant diets had no adverse effects on animal health. It also found that residual amounts of methanol (up to 0.5%) and sodium (up to 1%) had no adverse effects on animal health. However, a maximum level of 0.2% methanol is proposed for the EU Catalogue of Feed Materials required under Regulation 767/2009

18. EFSA noted that there were no data on other impurities or environmental contaminants present in glycerine from biodiesel production, such as catalysts, potassium, ethanol or other production aids. It concluded that these substances remained a concern to human and animal health unless it was proven that the chemical processes involved in biodiesel production with animal by-products inactivated these chemical contaminants, and recommended collection of data on the presence of these impurities in crude glycerine intended for animal feed.

19. According to the Foodchain and Biomass Renewables Association (FABRA), the use of glycerol and mineral salts derived from biodiesel production in animal feed has largely ceased in the UK (FABRA, 2010). All FAME production in the UK is made from Category 1 tallow and the value of Category 3 tallow means that the potential of FAME co-products being used as animal feed is unlikely in the near future.

Impacts on the feed industry

Feed Safety

20. In August 2008 following notifications through the Rapid Alert System for Food and Feed (RASFF), the European Commission asked all Member States to monitor for the presence of the antibiotic monensin in spent yeast from bioethanol production from Brazil that had been imported for animal feed. The levels reported in the notifications ranged from 0.3 - 30 mg/kg. EFSA published an Opinion on

[2] http://www.fabra.co.uk/

the cross-contamination of non-target feedingstuffs by monensin (2008) and a maximum permitted level (MPL) of 1.25 mg/kg monensin for feed materials was introduced under Directive 2002/32 (as amended by Commission Directive 2009/8/EC). Member States have informally reported that the use of monensin as an antimicrobial in biofuel production is rare in the EU.

21. According to Wu and Monkvold (2008), mycotoxins can be concentrated by up to a factor of three in dried distillers grains solubles (DDGS) compared to the original grain, as mycotoxins are not destroyed during biofuel production. To ensure feed safety and avoid production losses, biofuel producers should ensure good quality feedstocks are used and that regular testing for mycotoxins is carried out.

22. Co-products originating from GM biofuel feedstocks will require assessment and authorisation according to Regulation (EC) 1829/2003 on GM food and feed before they are permitted for use as animal feed. Therefore, co-products from fourth generation biofuel production may have little impact on the UK feed industry in the near future.

Feed Quality

23. Studies confirm that DDGS may be used as an alternative protein and energy source for a wide range of species (Archibeque et al, 2008; Bonoma et al., 2008; Christen et al., 2010; Loar et al., 2010; Schroeder, 2010; Stein et al., 2009; Widmer et al., 2008 and Youssef et al., 2008). The table below shows the relative protein levels found in cereal grains, soya bean meal and DDGS.

Feedingstuff	**Protein levels * (%)**
Cereal grains (UK)	9-13
Soya bean meal	~ 46-50
DDGS / rape meal co-products	25-35

Table 3. Protein levels of animal feedingstuffs.

**ideally should be based on g/kg and confirmed on a fresh or dry matter basis*

24. Several studies have shown that DDGS may be used for pigs and poultry to advantage, although the optimum inclusion level will be influenced by several factors, including the amounts and digestibility of the essential amino acids in DDGS (Loar et al., 2010; Stein, 2009; Widmer et al., 2008 and Youssef et al., 2008). A Defra LINK project "The environmental and nutritional benefits of

bioethanol co-products" (ENBBIO) has recently commenced which is investigating the use of DDGS as an alternative for imported soya bean meal in livestock diets in the UK. It aims to quantify the extent and sources of variability in UK wheat DDGS, identify limitations associated with feeding UK sources of DDGS, find ways of enhancing its value as a feedingstuff and examine processes to reduce fibre content (for non-ruminants) (ADAS, 2011). The project, which is coordinated by ADAS, involves Defra and 25 industry and academic partners, and results will be published late 2013.

25. Second, third and fourth generation biofuels are still in development in the UK. As the previous position paper concluded, the use of new feedstocks will produce co-products with significant differences in nutritional value and composition; however these are unlikely to have a significant impact on the UK feed industry in the near future.

Cost and availability of Feed Supplies

26. In April 2008, Defra produced a report on the impact of biofuels on commodity prices. It concluded that biofuel demand was not the only factor affecting commodity and fuel prices, and that increases in cereal prices appeared to be linked more to the quantity and quality of annual harvests and with stock levels than with structural changes in demand. However, the report also concluded that more research was required to understand the impact of biofuel demand on commodity prices, and to understand better the potential costs and benefits of biofuel production on food security and agricultural development.

27. The Renewable Fuels Agency's (RFA) Gallagher Review (2008) also looked at this issue, and concluded that increasing demand for biofuels contributes to price increases for some commodities, in particular oil seeds such as soya beans, but that the effects are complex. In January 2010, the Government's Global Food Markets Group produced a report on the 2007/8 agricultural price spikes, together with its causes and policy implications. The report concluded that biofuels only made a small contribution to the price spike, where the impact was largely limited to maize, with some knock-on effects on soya bean prices.

28. In July 2010 the World Bank published a working paper on the 2006 - 2008 commodity price boom, which considered the influence of biofuels on commodity prices (e.g. wheat or soya beans). It concluded that biofuels played some role in the boom, but less than originally thought. The paper suggested the cause was a mixture of factors (e.g. adverse weather conditions, biofuels, financialisation of commodities and Government policies) that brought global stocks of commodities to low levels, resulting in price spikes.

29. It is a requirement of the Renewable Energy Directive (Articles 22 and 23) that the effects of biofuels on commodity prices are monitored by EU Member States and the Commission.

Sustainability of biofuels and co-products for use in animal feed

30. In January 2008, the House of Commons Environmental Audit Committee published its First Report on the sustainability of biofuels. The report recommended a moratorium on policies aimed at increasing the use of biofuels due to concerns over sustainability. However, the Government argued against a moratorium because:
    - targets were set an 'appropriately cautious level';
    - an opportunity to make carbon savings from biofuels would be missed; and
    - it would mean reneging on an earlier commitment on whose basis investment decisions had been made.

31. Due to growing concerns about the sustainability of biofuels the Government commissioned Professor Ed Gallagher, the Chair of the RFA, to carry out a review of the indirect impacts of biofuels. The 'Gallagher Review' was published in July 2008 and recommended that, due to the risk of unintended indirect effects, the UK Government should slow down the rate of increase for the supply of biofuels. This resulted in the Renewable Transport Fuel Obligations (Amendment) Order 2009 (SI 2009/843) in April 2009.

32. As required by Article 4 of Directive 2003/30/EC, the UK was obligated to report to the European Commission on the UK Government's support for biofuels by 1 July 2010. This cited that the UK Government had set the following targets for suppliers:

Annual Target	**2008/09 (%)**	**2009/10 (%)**	**2010/11 (%)**
Feedstock meeting a qualifying environmental standard	30	50	80
Annual average greenhouse gas saving of biofuel supplied	40	45	50
Data reporting on sustainability characteristics	50	70	90

Table 4. Environmental targets for biofuel suppliers set under Directive 2003/30/EC.

33. To encourage the sourcing of sustainable biofuels, the RFA requires fuel suppliers claiming Renewable Transport Fuel Certificates to submit monthly reports on the GHG savings and the sustainability of the biofuels they supply.

34. The European Commission is required, by December 2010, to submit a report to the European Parliament and to the European Council, reviewing the impact of indirect land use change on greenhouse gas emissions and addressing ways to minimise that impact. The European Commission is also reviewing indirect land use change associated with biofuels and bioliquids.

35. Given improved sourcing of sustainable biofuels and increased use of home-sourced cereal feedstocks in biofuel production, the substitution of co-products for soya bean meal in animal feed appears to offer significant environmental and social benefits. Soya bean meal is currently the most significant protein source for animal feed in the EU, particularly for non-ruminant livestock. For a number of years over 80% of soya beans used in the EU has originated from South America, where the expansion of the soya bean industry has been linked to deforestation, desertification, loss of biodiversity, illegal appropriation of land, displacement of small farms and indigenous people and non-compliance with labour laws (FEFAC, 2009 & FAO, 2006). Feed production causes over 40% of GHG emissions, mostly linked to land use change from soya bean production, but also from the transport and processing of feed (FAO, 2006). Substituting wheat DGGS for imported soya bean meal in animal feed may result in potential GHG savings, where this is possible. Home-sourced cereal co-products may offer the best environmental benefits, although only nine percent of biofuel feedstocks originated from the UK in 2008-9 and a significant proportion of biofuels were produced from soya beans from South America (RTFO, 2010). The ENBBIO project is also investigating the contribution of the co-products to overall GHG balance of the UK, and quantifying the benefits of DDGS in reducing diffuse pollutants such as methane, nitrogen and phosphorus (ADAS, 2011).

Conclusions

1. **The Committee continues to anticipate no significant risk to consumer health from the use, in feed, of co-products from biofuel production**.

2. However, the Committee notes some concern regarding the presence of residues of contaminants in glycerol, although there is limited use in animal feed in the UK. Additionally, there have been two feed safety incidents relating to biofuel production in the last three years and concerns raised regarding the concentration

of mycotoxins in wheat DDGS. **Therefore, the Committee recommends that the Agency carries out research on the presence of impurities and contaminants in biofuel feedstocks and co-products that are intended for animal feed**.

3. There remains significant variability in the nutritional composition of biofuel co-products for animal feed, which can limit their use as feed for some species of food producing animal. **The Committee continues to believe that this does not cause a significant problem for the use of these products in feed**, as manufacturers can change their formulations to compensate for any nutritional variability**.** However, it may not be possible to substitute high protein feedstocks with biofuel co-products in feed for highly productive animals.

4. **The Committee noted that new types of biofuel feedstocks and associated technological developments in biofuel production are still in development in the UK and are unlikely to be used for animal feed in the near future**. However, ACAF believed that the biofuel industry is in a period of significant change with regard to the development of new feedstocks, new bioconversion technologies and the development of new production plants in the UK. **Therefore, this position paper should be reviewed regularly.**

ANNEX I

BIOFUELS – UPDATED GLOSSARY OF TERMS

Animal by-products (ABPs)		Animal carcases, parts of carcases or products of animal origin that are not intended for human consumption. This includes catering waste, used cooking oil, former foodstuffs, butcher and slaughterhouse waste, blood, feathers, wool, hides and skins, fallen stock, pet animals, zoo and circus animals, hunt trophies, manure, ova, embryos and semen.
Biodiesel[3]		Diesel fuel derived from plants.
Bioenergy		Renewable energy made available from materials derived from non-fossil biological sources e.g. wood agricultural crops, forestry and agricultural residues and organic waste.
Bioethanol[3]		Ethanol derived from plants via fermentation. Used for fuel.
Biofuels[3]		Liquid fuel manufactured from biomass (plants or animal products).
Biogas[3]		Gases produced from the digestion of biomass anaerobically. Consists largely of methane that can be burned as fuel.
Biomass[3]		Any living or recently dead plant or animal material.

[3] Definition taken from the UK's National Centre for Biorenewable Energy, Fuels and Materials website - 17 February 2012.

By-products		See co-products.
Cellulose		Complex carbohydrate which forms the chief component of plant cell walls.
Category 3 ABPs		Products from animals slaughtered fit for human consumption.
EFSA		European Food Safety Authority.
First generation biofuels		Already in use; established crops such as maize, wheat, oilseed rape, sunflower, soya beans and oil palm are used for biofuel. High protein animal feed in often a co-product.
FAME biofuel[3]		Fatty Acid Methyl Ester; biodiesel fuel manufactured from plant oils.
Feedstocks[3]		The starting material for a process, e.g. sugar cane, straw, wood.
Fossil fuel or mineral fuel		Any non-renewable carbon-containing fuel such as oil, peat, coal and natural gas that originates from decayed plants and animals.
Fourth generation biofuels		Anything over the horizon. There are some GM maize varieties on the market in the US produced for biofuel production. For example, a GM maize variety is grown in the US, aimed at the animal feed market and is being grown entirely for bioethanol production with a high value animal feed co-product. There is little prospect of GM energy crops being used in the near future in Europe.
Greenhouse gas (GHG)[3]		Greenhouse Gas; usually refers to carbon dioxide.
Global warming potential (GWP)		Allows comparisons of the warming potential of each greenhouse gas; it is the warming influence over 100 years relative to that of CO_2. Also known as CO_2 equivalent (or CO_2e).
Glycerol		A sugar alcohol which may be used as a feed material in relatively low incorporation rates. Also known as

		glycerine. Produced as by-product of the FAME biofuel production, but also can be manufactured from other sources.
Methanol		A toxic alcohol present as a contaminant in glycerol produced as a co-product of biodiesel production. Methanol can be stored in a conventional fuel tank and converted into hydrogen and carbon dioxide prior to use a hydrogen fuel cell, potentially removing the problems inherent in the storage and use of hydrogen as a source of power.
Miscanthus		A perennial grass that provide a high biomass yield. Currently grown for biomass but has the potential to produce biothanol commercially once second-generation technologies are further developed.
Renewable Transport Fuels Obligation (RTFO)		Requires suppliers of fossil fuels to ensure that a specified percentage of the road fuels they supply in the UK is made up of renewable fuels.
Renewable energy		Renewable energy comes from energy sources that won't run out: plants, sunlight, waves, wind. Plants can be made into biofuels and can be burned to make electricity and heat.
RFA		Renewable Fuels Agency.
Second generation biofuels		Non-food crops being developed and grown specifically as energy crops. Examples are *Miscanthus* and short rotation coppice willows, which have no food use. There are only a few thousand hectares of these in the UK at present. A lot of interest in the USA, with other species such as switchgrass and prairie crodrass also being evaluated. In the tropics, things like Jatropha and Pongamia, which are shrubby tress producing inedible oils, are also being evaluated. There is no feed co-product from this production type, but they could impact on feed availability if they are grown on land currently used for food/feed production. Most people talk of them being grown on ‘marginal’ land, although it is sometimes unclear what this means.

Third generation biofuels		Ethanol production from cellulose and other cell-wall polymers. These polymers can account for a large proportion of the carbon in straw, stems (for example, from *Miscanthus* and willow), and even grain, They are resistant to microbial digestion. Potential solutions are genetic changes to the plant to make these polymers more amendable to microbial digestion, or the development of microbial strains that can break the polymers down.

ANNEX II

REFERENCES

- ADAS (2011). Enbbio – Environmental and nutritional benefits of bioethanol co-products. http://www.adas.co.uk/Home/Projects/ENBBIO/tabid/338/Default.aspx.
- Archibeque, S.L, Freetly, H.C & Ferrell, C.L. (2008) Feeding distillers grains supplements to improve amino acid nutriture of lambs consuming moderate-quality forages. Journal of Animal Science, 86 (3): 691-701
- Bonoma, T.A, Brogren, A.C., Kline, K.H & Doyle K.M. (2008) Effects of Feeding Distiller's Dried Grains with Solubles on Growth and Feed Efficiency of Weanling Horses. Journal of Equine Veterinary Science, 28 (12): 725-727.
- Carere, C.R; Sparling, R; Nazim, C; & Levin, D.B. (2008) Third generation biofuels via direct cellulose fermentation. International Journal of Molecular Science, 9, 1342-1360.
- Christen, K.A, Schingoethe, D.J, Kalscheur, K.F, Hippen, A.R, Karges, K.K & Gibson, M.L. (2010) Response of lactating dairy cows to high protein distillers grains or 3 other protein supplements. Journal of Dairy Science, 93 (5): 2095-2104
- Commission Directive 2001/77/EC of the European Parliament and of the Council of 27 September 2001 on the promotion of electricity produced from renewable energy sources in the internal electricity market. http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CONSLEG:2001L0077:20100401:EN:PDF
- Commission Directive 2002/32 of the European Parliament and of the Council of 7 May 2002 on undesirable substances in feed.
- http://eur-lex.europa.eu/pri/en/oj/dat/2002/l_140/l_14020020530en00100021.pdf
- Commission Directive 2003/30/EC of the European Parliament and of the Council of 8 May 2003 on the promotion of the use of biofuels or other renewable fuels for transport. http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2003:123:0042:0046:EN:PDF
- Commission Directive 2009/8/EC of 10 February 2009 amending Annex I to Directive 2002/32/EC of the European Parliament and of the Council as regards maximum levels of unavoidable carry-over of coccidiostats or histomonostats in non-target feed.
- http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2009:040:0019:0025:EN:PDF
- Commission Directive 2009/28/EC of the European Parliament and of the Council of 23 April 2009 on the promotion of the use of energy from renewable sources and amending and subsequently repealing Directives 2001/77/EC and 2003/30/EC. http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2009:140:0016:0062:EN:PDF
- Commission Regulation (EC) No 1829/2003 of the European Parliament and of the Council of 22 September 2003 on genetically modified food and feed.

http://ec.europa.eu/food/food/animalnutrition/labelling/Reg_1829_2003_en.pdf

- Defra. (2008) The impact of biofuels on commodity prices. http://www.defra.gov.uk/evidence/series/documents/impact-biofuels-commodities.pdf
- Department of Transport. (2011) Consultation on the implementation of the transport elements of the Renewable Energy Directive. http://www.dft.gov.uk/consultations/open/. Accessed 20 April 2011.
- Diageo (2010). Bioethanol effects on methane. Personal communication.
- European Food Safety Authority (EFSA). (2010). Scientific Opinion on the abiotic risks for public and animal health of glycerine as co-product from the biodiesel production from Category 1 animal by-products (ABP). http://www.efsa.europa.eu/en/scdocs/scdoc/1934.htm. Accessed 22 December 2010.
- Ensus. (2010) Low carbon meat: reducing the carbon footprint of meat through greater use of biorefining cereal grains in Europe. http://www.ensusgroup.com/uploads/documents/Low%20carbon%20meat_Jan_2010.pdf
- Ensus. (2010) Information on biofuel co-products for the Advisory Committee on Animal Feedingstuffs. Personal communication.
- Fabra. (2010). Note for ACAF position on biofuels. Personal communication.
- Feed Compounder. (November 2010). Bioethanol plant gains planning consent. Page 14.
- FEFAC. (2009). Environment report, 1st edition, September 2009. http://www.fefac.org/file.pdf?FileID=22145
- Food and Agriculture Organisation of the United Nations (FAO). (2006). Livestock's long shadow. ftp://ftp.fao.org/docrep/fao/010/a0701e/a0701e00.pdf
- Global Food Markets Group, HM Government. (2010). The 2007/08 Agricultural Price Spikes: causes and policy implications. http://www.defra.gov.uk/foodfarm/food/pdf/ag-price100105.pdf
- House of Commons Environmental Audit Committee. (2008) Are biofuels sustainable? First report of session 2007-08. Volume 1. http://www.publications.parliament.uk/pa/cm200708/cmselect/cmenvaud/76/76.pdf
- Loar, R.E. 2nd, Moritz, J.S, Donaldson, J.R & Corzo, A. (2010) Effects of feeding distillers dried grains with soluble to broilers from 0 to 28 days posthatch on broiler performance, feed manufacturing efficiency and selected intestinal characteristics. Poultry Science, 89 (10): 2242-50
- Lywood, L, Pinkney, J & Cockerill, S. (2009) Impact of protein concentrate coproducts on net land requirement for European biofuel production. GCB Bioenergy, 1, 346-359.
- Renewable Fuels Agency. (2011) http://www.renewablefuelsagency.gov.uk/. Accessed 20 April 2011.
- Renewable Fuels Agency. (2009) Mitigating indirect effects of biofuel production. Case studies and methodology. http://www.renewablefuelsagency.gov.uk/sites/rfa/files/_documents/Avoiding_indirect_land-use_change_-_Ecofys_for_RFA.pdf
- Renewable Fuels Agency. (2008) The Gallagher Review of the indirect effects of biofuels production.

http://www.renewablefuelsagency.gov.uk/sites/rfa/files/_documents/Report_of_the_Gallagher_review.pdf

- Renewable Fuels Agency. (2010) Year One of the RTFO. Renewable Fuels Agency report on the Renwable Transport Fuel Obligation 2008/9. http://www.renewablefuelsagency.gov.uk/sites/renewablefuelsagency.gov.uk/files/_documents/year_one_of_the_rtfo_a4.pdf .
- Renewable Fuels Agency. (2010). RFA Quarterly Report 8: 15 April 2009 – 14 April 2010. http://www.renewablefuelsagency.gov.uk/sites/rfa/files/_documents/24_RFA_quarterly_report_Apr_2009_Apr_2010%20vpdf%20v2.pdf.
- Renewable Transport Fuel Obligations (Amendment) Order 2009 (SI 2009/843). http://www.renewablefuelsagency.gov.uk/sites/rfa/files/_documents/RTFO_Order_as_amended_April_2009.pdf
- Schroeder, JW. (2010) Distillers Grains: protein energy supplement for dairy cattle. NDSU extension service. http://www.ag.ndsu.edu/pubs/ansci/dairy/as1241.pdf
- Stein, H.H & Shurson, G.C. (2009) Board-invited review: the use and application of distillers dried grains with soluble in swine diets. Journal of Animal Science, 87 (4): 1292-1303.
- The Climate Change Act (2008). http://www.statutelaw.gov.uk/legResults.aspx?LegType=All+Legislation&title=climate+change&Year=2008&searchEnacted=0&extentMatchOnly=0&confersPower=0&blanketAmendment=0&TYPE=QS&NavFrom=0&activeTextDocId=3539938&PageNumber=1&SortAlpha=0
- The European Food Safety Authority. (2008) Opinion of the Scientific Panel on Contaminants in the Food chain on a request from the European Commission on cross-contamination of non-target feedingstuffs by monensin authorised for use as a feed additive. The EFSA Journal, 592, 1-40.
- The Biodiesel Duty (Biodiesel Produced from Waste Cooking Oil) (relief) Regulations 2010. http://www.legislation.gov.uk/uksi/2010/984/contents/made
- The World Bank Development Prospects Group. (2010). Placing the 2006/08 commodity price boom into perspective. http://www-wds.worldbank.org/external/default/WDSContentServer/IW3P/IB/2010/07/21/000158349_20100721110120/Rendered/PDF/WPS5371.pdf. Accessed 21 December 2010.
- Widmer, M.R, McGinnis, L.M, Wulf, D.M & Stein, H.H. (2008) Effects of feeding distillers dried grains with soluble, high-protein distillers dried grains, and corn germ to growing-finishing pigs on pig performance, carcass quality, and the palatability of pork. Journal of Animal Science, 86: 1819-1831
- Wu, F & Munkvold, GP. (2008) Mycotoxins in ethanol co-products: modelling economic impacts on the livestock industry and management strategies. Journal of Agricultural Food Chemistry, 56 (11): 3900-11.

- Youssef, IMI, Westfahl, C, Sünder, A, Libert, F & Kamphues J. (2008) Evaluation of dried distillers' grains with solubles (DDGS) as a protein source for broilers. Archives of Animal Nutrition, 62 (5): 404-414.