INTRODUCTION

Biofuelwatch appreciates the opportunity to comment on the Sustainable Framework for UK Aviation.

Our comments are primarily related to the proposed use of biofuels in aviation. In addition we have some general observations about the overall social and environmental impacts of aviation, and its long-term sustainability.

Biofuelwatch is wholly supportive of efforts to manage down man-made carbon emissions in order to mitigate the progression of climate change. We believe that reducing the levels of material and energy consumption is the most important and sustainable response to climate change, and should be given far greater emphasis. Replacing conventional energy and transport systems with low-carbon alternatives must also be a part of the overall approach, but the use of large scale bio-energy by 'developed economies' is not low-carbon and has such extensive social and environmental impacts across the world that it should not be used to combat either climate change or peak oil.

GENERAL OBSERVATIONS ON THE FRAMEWORK

Peak Oil

1. We welcome your recognition in para 1.2 that '*unconstrained growth of aviation is not an option*'. But this is a given, since the future availability of oil and other depleting resources make continual growth a physical impossibility. What is critical to examine in setting a framework for aviation policy is how long existing levels of traffic can be maintained before reductions have to be required in the light of shortages due to peak oil, or are a natural result of fuel price escalation. And as we discuss below, to what level is aviation allowed to expand at the expense of people and the environment away from the UK.

2. It is noteworthy that the framework does not mention peak oil as such, although there is an oblique and very brief reference to this in just one paragraph (1.11) under 'Energy Security'. This is striking given the absolute technical reliance of aviation on liquid fuels, and its economic dependence on cheap fuel to sustain current traffic levels. Omitting any consideration of peak oil appears to be contrary to the conclusion in DECC's June 2009 review of Peak Oil – 'Report on the risks and impacts of a potential future decline in oil production' – which recommended:

"Policies relating to oil consumption in the transport sector, particularly road and air travel, should continue to be monitored closely, as this sector will probably be most exposed to rising and volatile prices in the event of peak oil."

3. Several commentators have expressed the view that DECC's review was optimistic in its assessment of the timing and impacts of peak oil. Nonetheless the review does comment:

"Why does peak oil concern us?

Our current view is that a permanent decline in global oil production – i.e. peak oil – is unlikely to take place before 2020. However, if it were to happen, the consequences for economic prosperity and security are likely to be serious, with:

- *Impacts on UK security of oil supply*
- *Impacts on the prices for other fossil fuels such as gas and coal*

- *Disruption of the UK economy especially the transport sector*
- *Long term macroeconomic impacts (GDP, inflation etc) and impact on prices of other goods*
- *Possible impacts on our climate change goals*
- *Possible geopolitical implications*

The lead-times for Governments and economic systems to adjust to peak oil could be several years or even decades – with a potentially painful transition time. Therefore, it is prudent to more thoroughly explore the issues surrounding peak oil in the context of longer-term risk management."

In our view, a policy framework for aviation for the 21st century should include a much more extensive assessment of the impacts of peak oil.

Demand and Supply.

1. Para 1.11 suggests that energy security can be tackled both by reducing demand and by encouraging supply. Yet the Framework is nearly silent on the crucial question of demand reduction, acknowledging only briefly that video conferencing may have a role to play and proposing that high speed rail will offer an alternative to short haul air travel. Other than a passing reference to recent attitude surveys, there is no consideration given to managing demand through taxation or duties.

2. Calculations based on FAA data from 2004 show that the UK consumes a very high level of aviation fuel per head compared to other G7 countries. The UK consumption was exceeded only by the USA, and was over double that of France, German and Japan. It raises the question of 'travel efficiency', when other comparable economies can be equally successful but require much lower levels of flying.

3. The supply side is not discussed further at all, the implication perhaps being that fuel availability is not seen as an issue, and that increasingly biofuels can be used as needed to replace conventional fuels once the costs make this economically viable.

4. The consumer attitude surveys referred to in the Framework ask for opinions on the environmental impacts of aviation, and conclude that only a small proportion of the public would accept higher taxes or duties on aviation or restrictions on the numbers of flights. Our view is that such surveys are inadequate because they do not spell out to respondents the full range of social and environmental impacts from flying (or other damaging activities).

5. Replacing short haul flights with train services (including new high speed domestic train services) is of questionable value to the overall global emissions and environmental impacts of aviation since the slots freed up at UK airports as carriers reduce short haul flights will almost certainly be taken up by new long haul flights which are more damaging.

BIOFUELS

Summary

1. We are completely opposed to the use of biofuels for aviation, even those described as 'sustainable'. The criteria used to designate biofuels as sustainable do not consider many of the significant adverse impacts of biofuel production. Continuing to ignore these impacts when they are well reported and have been highlighted by bodies like the UN and the World Bank is wholly counter to the intended global spirit of

'Sustainable Development'. We describe in more detail the nature and scale of these impacts in the following sections.

2. Biofuels do not produce a meaningful reduction in green house gases (if at all) when all the relevant factors are taken into account. The official methodology used by the EU based on the UNFCCC to calculate the greenhouse gas balance of biofuels is flawed, and has been extensively criticized by scientists across Europe and the USA.

3. The EU ETS is also flawed in that it treats biofuel use in aviation as 'carbon neutral'. It is perverse in the extreme to have a carbon regulatory regime applying to road transport and power generation in which biofuels are deemed to produce GHG savings of as little as 19% (using the flawed and optimistic methodology mentioned above in point 2), and to say that the same biofuels will produce a 100% saving when burnt in planes. The industry group Sustainable Aviation itself uses a 50% GHG saving for aviation biofuels in its roadmap, again illustrating the flaw in the ETS.

4. Industry is proposing to use wastes as a feedstock for aviation biofuel, and has flown test flights on such fuel. The use of wastes might be helpful if there were any prospect of it leading to a meaningful reduction in fossil fuel use and GHG emissions. Neither is the case, as wastes are not available in anything like sufficient quantities. Using wastes to fuel aviation also means they are not available for other energy consumers, who will switch to either fossil fuels or to crop-based biofuels. We are concerned that the aviation industry is using its development of bio-kerosene based on Used Cooking Oil and tallow as a means to stimulate a so-called sustainable jet biofuel supply chain which will increasingly- and inevitably - rely on first generation crop feedstocks to deliver fuel in suitable volume.

5. Setting targets for the use of biofuels in aviation will accelerate the expansion of the global biofuel supply chain which is already servicing the UK's road transport market and the electricity power sector and is now targeting the heating sector. All of these sectors are making 'claims' on biofuels to reduce their carbon emissions and to give them greater energy security. It is impossible to satisfy the bioenergy requirement of any of these market sectors in a truly sustainable way. The combined impacts on people and ecosystems are much greater than a simple summation of the individual impacts of various market sectors. The negative impacts do not have a linear relationship to scale.

6. The biofuel industry asserts that increased scale will lead to sustainable production and stimulate investment in new technologies to create lower impact biofuels. The experience with road transport biofuels is exactly the opposite. Targets and mandates have lead to an investment rush, land grabs and exploitation of people in poorer countries to make way for monoculture crop plantations dedicated to supplying the UK and other export markets. Industry has chosen the lowest possible cost options to gain competitive advantage, moving feedstock and finished product around the globe, opening and shutting facilities in response to price movements and different subsidy levels. Jatropha projects in Africa and India have failed for example and left people without jobs or land and made them reliant on expensive food from distant markets.

7. As long ago as 2008, the Gallagher Review recommended a slow down in the expansion of road transport biofuel consumption until the full range of impacts had been properly considered. Since then, UK Govt. has incentivised the power sector to start using biofuels through the Renewable Obligation, opened up the possibility of biofuels use for heating buildings, and has encouraged the use of biofuels in aviation. Policy on how and when to expand biofuel consumption has been wholly inconsistent, and is plainly not following the precautionary principle. To encourage biofuel use in new sectors without a clear understanding and acceptance of responsibility for the impacts of production overseas is a serious injustice to their people.

8. Approximately 80% of biofuels currently used in UK road transport are imported. It is widely agreed that UK expectations for bio-energy expansion can only be met by continued high levels of imports. (AEA Technology report from March 2011 for example). If UK aviation continues at its current level or is to expand, the use of biofuels will therefore impact people in producing countries – who don't fly – far more than people in the UK who are enjoying the benefits. These people are already disadvantaged and will suffer the consequences of global warming earlier and to a far greater extent than Britons.

9. Second and third generation biofuels such as Jatropha and Algae are proposed as sustainable alternatives to those made from food crops. But attempts to produce meaningful quantities of biofuel from Jatropha on so-called marginal and arid land have consistently failed. The industry is resorting to genetic modification of Jatropha to try to achieve the yields to possibly make this a plausible feedstock. Algae-based biofuels have never got beyond pilot scale production, and there are no credible technical developments to indicate progress can be made in the next decade or so. Last year the US Govt. scaled back its expectation (target) under the 2007 Energy Security Act for cellulosic ethanol from 950 million liters to 25 million litres, because of technical difficulties and lack of investment.

10. The aviation industry talks about using other feedstocks like Camelina, Babassu and Algae, to make 'sustainable' oil-derived biofuels, when it is clear that these feedstocks do not currently provide the volumes required, and would require very extensive land areas, technical breakthroughs and continued high levels of investment to create a viable supply chain. In our view, the most likely development path will instead be for the industry to use existing well-established supply chains based on high-yielding vegetable oil crops, including palm oil.

11. In parallel with oil-derived fuels, the industry is intending to make aviation biofuel from plant sugars and from woody biomass. This will inevitably mean additional food crops, or land currently growing food, being allocated to biofuels; and the destruction of natural forests for conversion to plantations of oil crops or woody energy crops.

12. The great majority of biofuel used in UK road transport is still derived from sugar cane and soybean, and we see no plausible reasons to suggest the aviation industry would not take advantage of the established global supply chains in such commodities delaying a move to 'more sustainable alternatives' as long as possible.

13. An extremely wide range of projections is in publication suggesting ways to manage aviation's greenhouse gas emissions, in particular the extent to which biofuels should be used and how much they contribute to emissions reduction. The very wide disparity among experts, policy makers and industry bodies suggests there is little reliable evidence, and in our view the speculative conclusions being drawn are of very limited value. To initiate a global biofuel expansion plan lasting decades and affecting millions of vulnerable people based on such uncertain projections would be extremely unsound and irresponsible.

14. In their December 2009 study, the Committee on Climate Change reviewed the use of biofuels and hydrogen in aviation. They reported that IATA were projecting that aviation biofuels made from hydro-treated vegetable oils would produce a 70-90% **negative saving** (ie an increase relative to fossil fuels) when land use change effects were factored in. In contrast, aviation biofuels made using the Biomass to Liquid process were estimated to produce a saving of 60-90%.

15. The World Economic Forum report in May 2011, '*Policies and Collaborative Partnership for Sustainable Aviation*' forecast a growth in global aviation emissions

from 630 million tonnes in 2010 to 2 billion tonnes in 2050, even with improved efficiencies from new planes and better operations. The report concluded that 90% of the fuel would need to be biofuels to reverse that growth in emissions and to deliver the stated industry goal of halving global aviation emissions by 2050. (We note that this calculation assumes over 90% carbon neutrality for all the biofuels, which is simply impossible) The actual biofuel consumption rate in this projection would need to be **13.6 million barrels per day in 2050** - **or over 2 billion litres per day**. To put this into context, total global biofuel consumption in 2010 was only 0.3 billion litres per day (105 billion litres for the year).

http://www.weforum.org/reports/policies-and-collaborative-partnership-sustainable-aviation?fo=1

16. Encouraging or mandating the use of biofuels in aviation in an attempt to reduce carbon emissions will divert attention and investment away from the essential and increasingly urgent requirements to reduce demand, to improve aviation efficiency and to develop alternative less polluting forms of transport.

BIOFUELS – EVIDENCE

Social Impacts in producing countries

1. The provisions made in the EU Renewable Energy Directive (RED) regarding the social impacts of biofuel production provide no safeguards. They simply require the EC to report on the impacts; they do not set out any means of measurement or thresholds for 'acceptable' impacts, nor do they provide a means or timescale for rectification. The timetable for EC reporting is protracted (and is not defined) and is likely to mean the first impact analysis will not be fully considered and acted on much before the end of this decade. The recent history with the EC's assessment and reporting on the impacts of Indirect Land Use Change - delayed by 6 months then considered too complex and controversial to factor into biofuels' carbon balance – is a very strong indication to us that social impacts will never be properly considered.

2. As a result, the biofuel supply chains which are already causing high levels of social impact such as food insecurity, land tenure disputes and more serious human rights abuses will continue and worsen as biofuel production increases in scale. The impacts will be magnified as rising population, a move to more prosperous diets, and weather volatility worsen food availability and increase competition for land and water resources.

3. Without properly considering social impacts, defining limits and providing for sanctions, the RED's definition of 'sustainability' for biofuels is incomplete and is already causing harm to people in poorer countries.

4. UK aviation policy that promotes 'sustainable' biofuels on the basis that they meet the criteria in the EU RED would be repeating and compounding the error. And continuing to ignore the considerable evidence that biofuel production is a major factor in world hunger and is triggering acquisitive land deals in poorer countries.

5. According to a forthcoming report by the International Land Coalition (ILC), as much as 44 percent of global land deals in 2009 were for biofuels. The ILC says this amounts to about 35 million hectares.

www.future-agricultures.org/index.php?option=com_docman&task=doc_download&gid=1427&Itemid=510

6. The United Nations has identified the UK as the third largest land grabber after China and Saudi Arabia with over a million hectares acquired, primarily in Africa. The aim of these UK projects is stated to be for biofuels. This area represents about 10% of UK agricultural land. See figure 2 of:

http://na.unep.net/geas/newsletter/Jul_11.html

7. Yet, the Intergovernmental Panel on Climate Change (IPCC), for example, warns that Africa is one of the most vulnerable continents to climate change. Agricultural yields could fall by up to 50 percent by 2050 in some countries and, by 2020, up to 250 million people are projected to face increased water stress due to climate change.

8. Both the United Nations and IFPRI have very recently reported separately on Food Insecurity and Global Hunger, noting that biofuel production continues to impact negatively and expressing concern that this will worsen.

> *World hunger report 2011: High, volatile prices set to continue*
>
> http://www.fao.org/publications/sofi/en/
>
> *New Global Hunger Index Report Calls for Action to Curtail High and Volatile Prices and Protect the Poor*
>
> http://www.ifpri.org/pressrelease/new-global-hunger-index-report-calls-action-curtail-high-and-volatile-prices-and-protec

9. Oxfam echoed these concerns last month (Sept 2011) saying:

The NGO has identified 227m ha (561m acre ha) of land – an area the size of north-west Europe – as having being reportedly sold, leased or licensed, largely in Africa and mostly to international investors in thousands of secretive deals since 2001. This compares with about 56m ha identified by the World Bank earlier this year, again predominantly in Africa.

The new land rush, which was triggered by food riots, a series of harvest failures following major droughts and the western investors moving out of the US property market in 2008, is being justified by governments and speculators in the name of growing food for hungry people ***and biofuels for environmental benefit.***

But, says Oxfam, "many of the deals are in fact 'land grabs' where the rights and needs of the people previously living on the land are ignored, leaving them homeless and without land to grow enough food to eat and make a living".

"Many of the world's poorest people are being left worse off by the unprecedented pace of land deals and the frenetic competition for land. The blinkered scramble for land by investors is ignoring the people who live on the land and rely on it to survive," said Oxfam chief executive Dame Barbara Stocking.

Oxfam expects the land grabbing to increase as populations grow. The report said: "The huge increase in demand for food will need to be met by land resources that are under increasing pressure from climate change, water depletion, and other resource constraints, ***and squeezed by biofuel production****, carbon sequestration and forest conservation, timber production, and non-food crops."*

10. Friends of the Earth Europe in their June 2010 report, '*Africa up for Grabs*' documented many cases where land had been grabbed, saying

"5 million hectares of land, an area the size of Denmark, has been acquired by European companies for biofuels in 11 African countries."

http://www.foeeurope.org/agrofuels/FoEE_Africa_up_for_grabs_2010.pdf

11. The biofuel industry does not try to hide the fact that land grabbing is endemic. An on-line article in Biofuel Digest from July this year contained this passage:

"RISING CHINA ENERGY DEMAND
In short, it doesn't take an African land-grabber to understand that the export trade to China in feed, food, fiber and biofuels is going to grow, substantially and swiftly"

http://biofuelsdigest.com/bdigest/2011/07/05/the-rising-tigers-of-the-china-bioenergy-trade/

Greenhouse gas balances

1. Biofuels used in road transport can only count towards EU renewable energy targets if they meet a threshold saving of 35% in estimated lifecycle greenhouse gas emissions compared to equivalent fossil fuels. Yet the EU ETS allows aviation biofuels – with similar, possibly more energy intensive production methods - to be counted as though they produce a 100% saving, i.e. treating them as 'carbon-neutral'. This is obviously inconsistent and cannot be defended on scientific grounds.

2. The methodology used by the EU to estimate biofuel greenhouse gas savings is however incomplete – it does not factor in all the effects of land use change, both direct and indirect, which reduce the savings and in many cases mean that biofuels are worse for the climate than fossil fuels. Peer-reviewed research over the last several years, including studies commissioned by the European Commission, indicates that conventional biofuels can directly or indirectly result in substantial GHG emissions through the conversion of forests and grasslands to croplands or pasture to accommodate biofuel production. Biofuelwatch summarised the situation in 2008:

http://www.biofuelwatch.org.uk/wp-content/uploads/lca_assessments.pdf

3. For example, Fargione reported that Palm oil grown on peatland in Southeast Asia could leave a 'carbon debt' of 840 years before any emissions savings from avoiding the use of fossil fuel would compensate for the initial releases of greenhouse gases in clearing and draining land to create plantations.

4. Crutzen estimated that the global warming effects of Nitrous Oxide released during cultivation of certain biofuel feedstock crops would completely outweigh possible in-use emissions savings, saying for example that biodiesel made from rapeseed could generate as much as 70% more emissions than fossil fuels.

5. This year, the European Commission decided not to make any changes to the greenhouse gas lifecycle estimates for biofuels to account for Indirect Land Use Change (ILUC). It has not said that indirect land use changes don't worsen the greenhouse gas balances of biofuels, just that it is not possible to assess those effects accurately enough, and it requires another 7 years to produce a new lifecycle methodology. As a consequence, the claimed greenhouse gas savings from biofuels will continue to be knowingly overstated, with their overall negative climate impacts increasing as usage levels climb.

6 Prior to the EC announcing its position on ILUC, 150 scientists and economists wrote to the EC stressing the importance of improving the biofuel emissions lifecycle analysis methodology:

"There are uncertainties inherent in estimating the magnitude of indirect land use emissions from biofuels, but a policy that implicitly or explicitly assigns a value of zero is clearly not supported by the science," the letter states. "All the studies of land use change indicate that the emissions related to biofuels expansion are significant and can be quite large."

http://www.ucsusa.org/news/press_release/scientists-warn-european-0566.html

7. On 15 September 2011, the Scientific Committee of the European Environment Agency, issued a report critical of the methodology, saying that it including a basic accounting error:

"It is widely assumed that biomass combustion would be inherently „carbon neutral' because it only releases carbon taken from the atmosphere during plant growth. However, this assumption is not correct and results in a form of double-counting, as it ignores the fact that using land to produce plants for energy typically means that this land is not producing plants for other purposes, including carbon otherwise sequestered."

The Committee warned that:

"The potential consequences of this bioenergy accounting error are immense. Based on the assumption that all burning of biomass would not add carbon to the air, several reports have suggested that bioenergy could or should provide 20% to 50% of the world's energy needs in coming decades. Doing so would require doubling or tripling the total amount of plant material currently harvested from the planet's land. Such an increase in harvested material would compete with other needs, such as providing food for a growing population, and would place enormous pressures on the Earth's land-based ecosystems. Indeed, current harvests, while immensely valuable for human well-being, have already caused enormous loss of habitat by affecting perhaps 75% of the world's ice- and desert-free land, depleting water supplies, and releasing large quantities of carbon into the air."

http://www.eea.europa.eu/about-us/governance/scientific-committee/sc-opinions/opinions-on-scientific-issues/sc-opinion-on-greenhouse-gas

Biofuel Feedstocks

1. It is clear to us that aviation, like road transport, will target the cheapest most readily available biofuels, particularly when high impact readily available feedstocks like palm oil – which produce a very low or negative greenhouse gas saving - are not excluded from use under the EU ETS as they will be under the Renewable Energy Directive / RTFO. The aviation industry's pledges to use waste oils and crop feedstocks that don't affect food, forests or biodiversity, are completely implausible when the volumes required and the price disparity are taken in to account.

2. It has been suggested that the aviation industry might be prepared to pay premium prices for fuel made using complex chemical/biological processes, from algae or using the energy-intensive Fischer Tropsch 'Biomass to Liquid' process. Our view is that aviation is not prepared to wait for these fuels however and will inevitably begin by using first generation biofuels made from readily available food crops with the stated intention that when 2nd and 3rd generation alternatives come on stream at acceptable

prices and supply volumes, they would switch. We think this is highly unlikely to happen this decade. Even if 'advanced' fuels do eventually achieve price parity with conventional Jet-A, due to rises in the price of crude oil, first generation biofuels will have become the cheapest if global production has been allowed to continue expanding.

3. The development of next generation biofuels has not made anything like the progress envisaged in the early 2000's. For example, in June this year, the US Government again cut its targets for cellulosic bioethanol. Next year, only 3.45 million to 12.9 million gallons of cellulosic biofuel will have to be blended, far below the original goal of 500 million gallons. The Environmental Protection Agency had already cut the target for 2011 to 6 million gallons from the 250 million gallons required in the renewable fuels standard Congress passed in 2005.

4. Algae biofuels are described as 'promising', but there are still no production scale facilities anywhere despite high levels of commercial investment and government research funding. In their 2010 report, '*A Realistic Technology and Engineering Assessment of Algae Biofuel Production*,' the Energy Biosciences Institute concluded that:

"Even with relatively favorable and forward-looking process assumptions (from cultivation to harvesting to processing), algae oil production with microalgae cultures will be expensive and, at least in the near-to-mid-term, will require additional income streams to be economically viable…It is clear that algal oil production will be neither quick nor plentiful – 10 years is a reasonable projection for the R, D & D (research, development and demonstration) to allow a conclusion about the ability to achieve, at least for specific locations, relatively low-cost algal biomass and oil production."

http://www.energybiosciencesinstitute.org/media/AlgaeReportFINAL.pdf

5. It's instructive to consider how reliable past predictions on advanced biofuels have been. In the NNFCC Position Paper, *The Potential for Renewable Aviation Fuels*, published February 2007, the authors described the Choren BTL proposal as one of the most promising:

"Probably the BtL refinery using Fischer-Tropsch technology that is closest to commercialisation is Choren in Freiburg, Germany. Choren are currently building a 75,000 tonne/year plant (mainly woodchips). This plant will produce 19 million litres per year of fuel (Sundiesel for automotive use) and is expected to be in production by mid 2007."

In January this year, Shell announced it was pulling out of joint ventures in both algal biofuel developments (Cellana) and Fischer Tropsch BTL (Choren). In July, Choren filed for insolvency.

6. The recent biofuel test flight by Thomson Airways from Birmingham ran on hydro-treated Used Cooking Oil (UCO), processed in Louisiana. The fuel supplier SkyNRG responded to Biofuelwatch and Airportwatch criticism that more frequent flights would not be able to be fuelled with UCO biofuel, saying that:

"In addressing the challenge to replace fossil kerosene in a sustainable way, aviation has no alternative but liquid hydrocarbons from bio-based (waste) sources."

http://www.greenaironline.com/photos/SkyNRG_reaction_to_AirportWatch.pdf

In effect this is a statement from the industry that "only waste-based aviation biofuels are sustainable", yet Thomson have proposed this month using Camelina and Babassu nuts as preferred feedstocks to eke out limited supplies of UCO.

7. It is obvious to us that there are very limited supplies of UCO (and other wastes) available to be used as a biofuel feedstock. DfT's data for the year to April 2011 on the use of fuel governed by the RTFO show that 50% of UK transport biodiesel came from UCO, and 6% from Tallow. UCO was imported from eighteen countries, including the USA and Chile. More was imported from the Netherlands than was sourced from within the UK.

8. 2010 consumption rates for wastes in UK road transport biofuel (same source) were:

Used Cooking Oil	0.43 million tonnes (of which 0.1 million tonnes was UK sourced)
Tallow	0.05 million tonnes
Municipal Solid Waste	0.004 million tonnes

9. The amount of UK-sourced UCO in biodiesel equates to approximately 1.6kg per capita per year. Data from DEFRA give the UK per capita purchase of fats for domestic consumption in 2010 as 9.4kg (that's all oils, spreads, butter, lard etc). At a wastage rate of 10% and assuming (unrealistically) that all such waste could be collected for processing, the domestic market could yield around 1 kg per capita for processing into fuel. Additional UCO is available from the catering and processed food industries, but in our view this source is unlikely to be able to yield amounts much above the current level of 1.6kg per capita, insufficient to make more than a very small contribution to aviations' needs

10. Camelina is an oilseed crop which is currently grown on only a very small scale in North America. According to US Government figures, the average yield for camelina in 2010 was 1029 lbs/acre, which is 1.15 tonnes/hectare. By comparison, average rapeseed oils yields are 3 tonnes/hectare.

www.nass.usda.gov/Statistics_by_State/Montana/Publications/Press_Releases_Crops/camelina.pdf

Despite aviation industry claims, camelina is an established, albeit small-scale, food crop.

11. Jatropha has been widely and heavily promoted as a biofuel crop that can be grown on marginal lands in Africa and India with little or no demands for water or fertiliser, and which does not compete with food production. When grown on so-called marginal land, however, yield expectations have simply not been met. Industry has started developing GM varieties ('Jatropha 2.0') to deal with the shortcomings. In the meantime, existing jatropha plantations are being abandoned and new plantations are being developed on fertile land, displacing existing high-yielding food production.

12. Concerns about jatropha yields are now widespread: Indian and Chinese researchers present a good summary in '*The Extraordinary Collapse of Jatropha as a Global Biofuel*' published August 2011:

"In India the provisions of mandatory blending could not be enforced as seed production fell far short of the expectation and a recent study has reported discontinuance by 85% of the Jatropha farmers. In China also until today there is very little production of biodiesel from Jatropha seeds. In Tanzania the results are very unsatisfactory and a research study found the net present value of a five-year

investment in Jatropha plantation was negative with a loss of US$ 65 per ha on lands with yields of 2 tons/ha of seeds and only slightly beneficial at US$ 9 per ha with yields of 3 tons when the average expected Jatropha seed yield on poor barren soils is only 1.7 to 2.2 tons/ha. Even on normal fertile soils (average seed yield 3.9 to 7.5 tons/ha) Jatropha was no match for sunflower."

"It [Jatropha] appears to be an extreme case of a well intentioned top down climate mitigation approach, undertaken without adequate preparation and ignoring conflict of interest, and adopted in good faith by other countries, gone awry bringing misery to millions of poorest people across the world. And it happened because the principle of "due diligence" before taking up large ventures was ignored everywhere. As climate mitigation and adaptation activities intensify attracting large investments there is danger of such lapses becoming more frequent unless "due diligence" is institutionalized and appropriate protocols developed to avoid conflict of interest of research organizations."

http://pubs.acs.org/doi/full/10.1021/es201943v

13. SG Biofuels made these observations when launching its Jatropha 2.0 programme in May 2011:

"We are not saying that we are going back to jatropha 1.0,"commented Haney, "and saying that on horrible land with insufficient soil quality, rainfall or fertilizer that these numbers can be achieved. Jatropha needs inputs. Plus, rainfall and slope variations – microclimates – have to be considered; we will have multiple seeds for a given large-scale farm."

14. Other comments from the jatropha industry this year confirm that jatropha cannot be economic with fertiliser and water:

"The idea that jatropha can be grown on marginal land is a red herring," Harry Stourton, Business Development Director of UK-based Sun Biofuels, which cultivated jatropha in Mozambique and Tanzania. "*It does grow on marginal land, but if you use marginal land you'll get marginal yields,"* he said.

Sun Biofuels estimated its Mozambique plantation, once it matures in two years, may yield two tonnes of oil per hectare of jatropha, and notes it is grown with fertilizers and pesticides on the fertile land of former tobacco fields. (Sun Biofuels went into administration this year after failing to pay its local staff.)

"Jatropha is not the miracle crop that many people think it is," said Dominic Fava, *business development manager of British biofuels firm D1 Oils, which processes jatropha grown in Asia and Africa. It is perhaps inappropriate to be offering guaranteed returns at such a stage of domestication, when we've still got a lot to learn about this crop*," said Fava.

15. Many NGO reports have shown that jatropha production is negatively affecting lives, livelihoods and biodiversity in producer countries. For example:

Jatropha: money doesn't grow on trees, Friends of the Earth International (December 2010)
www.foeeurope.org/download/jatropha_FoEIreport_Jan2011.pdf

Jatropha biofuels in Dakatcha, Kenya - the climate consequences, ActionAid (March 2011)
http://www.actionaid.org.uk/102821/new_study_reveals_biofuels_carbon_con.html