

# Biofuels – solution or problem?

## Introduction

Biofuels have been touted as a solution to two growing international problems. Firstly, they have been viewed as a means of providing international energy security in a world where the majority of fossil fuels are located in some of the most volatile regions. Secondly, their use can help in addressing climate change, as the substitution of biofuels for fossil fuels is seen as a way to reduce the levels of greenhouse gas emissions. These benefits ensured overwhelming support for biofuels in western countries. In 2003 the EU adopted a Biofuels Directive which required member states to set targets for the minimum proportion of biofuels to be mixed with regular petrol and diesel. By 2005 this target was 2%, rising to 5.75% by 2010.<sup>1</sup> Following this lead President Bush backed their use in his State of the Union address in January 2006 when he demanded that Americans “move beyond a petroleum economy, and make dependence on Middle East oil a thing of the past. We must replace more than 75% of Middle East oil imports by 2025.” Part of this target was to be achieved through replacing oil with biofuels.

Biofuels can also mitigate some of the impacts of fossil fuel use in the transport sector, which in 2004 was responsible for 28% of UK carbon emissions (predicted to rise each year until 2015)<sup>2</sup> and accounted for 74% of the UK’s consumption of oil.<sup>3</sup>

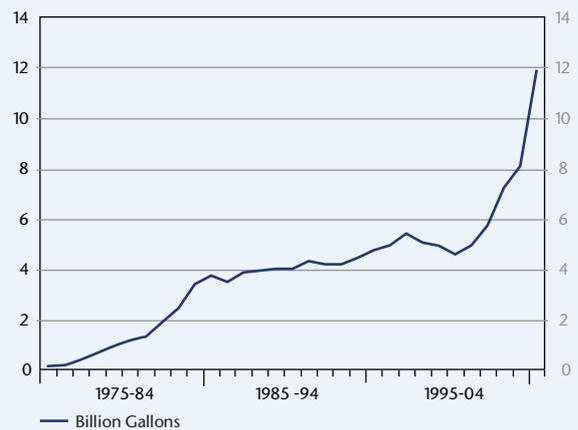
## Industry expansion

Overt support from the US President for the biofuel industry spurred an already booming industry, whose growth in the years before 2005 is illustrated in charts 1 and 2. In 2005 the United States became the world’s leading producer of ethanol, a key source of biofuels. In 2007 the US accounted for nearly half of worldwide ethanol production.<sup>4</sup> In terms of volume US ethanol production has quadrupled from 1.6 billion gallons in 2000 to an estimated 6.4 billion gallons in 2007, and the figure is expected to increase to 15 billion gallons by 2015.<sup>5</sup> Around a third of the US corn crop is now dedicated to ethanol production, a 50% increase on the figure for 2005.<sup>6</sup>

Biodiesel, which is processed from vegetable oils derived from soy beans, oil palm, and rapeseed, among other crops, has also witnessed a boom in production on a global scale, and production more than quadrupled between 2000 and 2005.<sup>7</sup> The majority of the fuel is produced in Europe, though much media attention has focussed on the development of palm oil plantations in South East Asia, the end product of which has supplemented western biodiesel demands.

Chart 1

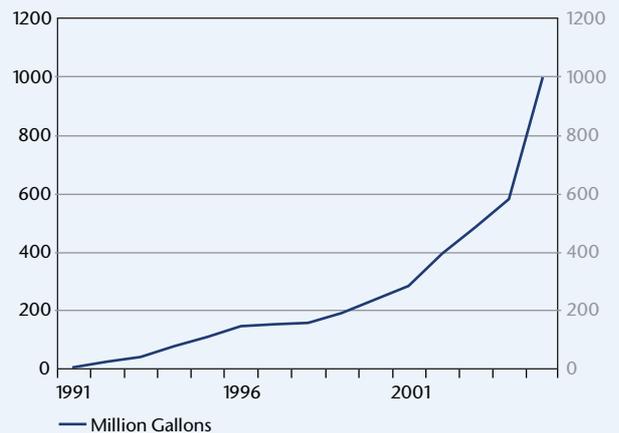
World ethanol production, 1975-2005



Source: EarthTrends, 2007 using data from Earth Policy Institute, 2006

Chart 2

World biodiesel production, 1991-2005



Source: F.O. Licht, Worldwatch

<sup>1</sup> European Commission Agriculture and Rural Development. ‘An EU Strategy for Biofuels’. [http://ec.europa.eu/agriculture/biomass/biofuel/index\\_en.htm](http://ec.europa.eu/agriculture/biomass/biofuel/index_en.htm)

<sup>2</sup> ‘Reducing Carbon Emissions from Transport’, House of Commons Environmental Audit Committee, 2006

<sup>3</sup> <http://www.publications.parliament.uk/pa/cm200506/cmselect/cmenvaud/981/981-i.pdf>

<sup>4</sup> *ibid.*

<sup>5</sup> <http://www.whitehouse.gov/news/releases/2008/03/20080305-2.html>

<sup>6</sup> *ibid.*

<sup>7</sup> Dresdner Kleinwort research paper: ‘Biofuels: The Food versus Fuel debate’ July 2008.

<sup>8</sup> [http://www.earth-policy.org/Updates/2006/Update55\\_data.htm#fig2](http://www.earth-policy.org/Updates/2006/Update55_data.htm#fig2)

## Biofuels and food prices

Despite the initial perception of the benefits of replacing fossil fuels with biofuels, the industry's expansion has not been universally welcomed, and a growing backlash is threatening its continued viability.<sup>8</sup> Since President Bush's 2006 State of the Union speech, several high profile reports have focused on the link between the rapid increase in corn-based ethanol production and rising international food prices.<sup>9</sup>

This issue mainly concerns bioethanol, a petrol replacement which can be manufactured from a number of raw materials, including corn. At present corn is the principal source of US bioethanol, the same corn that a few years ago was earmarked for food. The reduction in supply of corn and cornflour on world commodity markets has been linked to the diversion of a proportion of the US crop to bioethanol, and this is believed by critics to have led to a rise in price as demand outstrips the remaining supply. These critics theorise that the global nature of commodity markets means a rise in US corn prices affects corn prices elsewhere, as buyers look for cheaper corn in other countries. This increases demand which leads to a price rise.

These rises have been steep. Chart 3 illustrates that the price of US corn over the last decade has risen from around \$2 per bushel in 1999, to around \$7 per bushel in 2008. Recent rises have been especially dramatic with the price of December 2008 corn futures rising from \$4.0825 per bushel in July 2007 to \$6.8625 in July 2008, an increase of almost 70%.<sup>10</sup> This rise in the price of corn has been linked with food riots in a number of developing countries, and has also had a knock-on effect on other foods, particularly meat and dairy products. Corn is often used as feed for livestock and the rise in price has caused US meat, dairy and poultry producers to ask the White House to reduce the amount of corn being diverted to ethanol because the rise in feedstock prices threatens their livelihoods.<sup>11</sup>



Whether the diversion of US corn for biofuels is largely responsible for these price rises is the subject of much debate. Other contributory factors such as droughts in Australia, frosts in China,

crop failures in mid West America, global population growth and changing diets in Asia to favour meat instead of arable products, as well as increased distribution and transportation costs due to the rising cost of oil, are all also likely to have exerted upward pressure on corn prices. But there is no doubt that much hostility towards biofuels is based on their perceived involvement in swallowing up corn supplies which would otherwise have been used for food.

This link is backed by the Gallagher Review published in July 2008 by a panel of UK experts chaired by the head of the Renewable Fuels Agency and commissioned by the UK government. The Gallagher Review found a significant link between the rush to develop biofuels and rising food prices, stating that biofuels would contribute up to an extra 15% to the price of grain in the EU by 2020 if current targets were followed through.<sup>12</sup>

Biofuels targets have been mandatory in the UK since April 2008, when it became law that 2.5% of all petrol and diesel sold on garage forecourts was to be biofuel. This is due to increase to 5% by 2010<sup>13</sup>, marginally less than the level stated in the EU Biofuels Directive. In the EU it is proposed that this level reach 10% by 2020. These targets are being questioned by many people including politicians and environmental groups, and some have predicted that Gordon Brown will use the Gallagher Review's findings to pressure the EU into abandoning its 10% target.

The release of the Gallagher Review followed a summit meeting in Rome where world leaders discussed the impact of biofuels, and where the International Monetary Fund estimated that between 20% and 30% of food price rises could be attributed to their use.<sup>14</sup> A report by the US Department of Agriculture, on the other hand, claims the impact was less than 3%.<sup>15</sup>

## Are biofuels 'green'?

### Biofuels and reduced carbon emissions

Alongside the advantage of reducing dependence on fossil fuels from unstable regions of the world, a key selling point of biofuels has been that they emit less carbon dioxide than fossil fuels when burnt. A study commissioned by the UK government in 2003 concluded that 'generally all renewable transport fuel chains would result in substantial emission reductions compared to conventional fossil fuels'. The only exception to this was ethanol derived from sugar beet, and only when total emissions were calculated on a worst-case scenario basis. Carbon savings per gigajoule of fuel were believed to be in the range of between 20% and 80%, depending on fuel type.<sup>16</sup> The only exception to this was ethanol derived from sugar beet, and only when total emissions were calculated on a worst-case scenario basis.

However, doubt has been cast on this claim in a number of studies which have taken into account the entire life cycle of biofuels from field to the fuel pump. One study looked at emissions from biofuels derived from two of the most common sources of biofuel, rapeseed and maize, and found they emitted over 50% more greenhouse gases than fossil fuels. This was revealed following the discovery that these fuels produced much higher amounts of nitrous oxides, a potent greenhouse gas, than previously thought.<sup>17</sup>

<sup>8</sup> In October 2007 a United Nations food expert, Jean Ziegler, condemned the diversion of arable land to produce fuel as a 'crime against humanity'.

<sup>9</sup> The Gallagher Review and a report produced by the World Bank ('A Note on rising Food Prices', D. Mitchell), published in July 2008, both linked biofuels to rising global food prices.

<sup>10</sup> Bloomberg, 2008

<sup>11</sup> 'US food producers urge ethanol rethink', Financial Times, 20.06.08

<sup>12</sup> The Gallagher Review, 2008. p. 59

<sup>13</sup> The Renewable Transport Fuels Obligation or 'RTFO'.

<sup>14</sup> The Guardian, 'New study to force ministers to review climate change plan', 19 June 2008.

<sup>15</sup> 'Corn Prices Near Record High, But What About Food Costs?'. Leibtag, Feb 2008. US Department of Agriculture, Economic Research Service <http://www.ers.usda.gov/AmberWaves/February08/Features/CornPrices.htm>

<sup>16</sup> 'Technology Status Review and Carbon Abatement Potential of Renewable Transport Fuels in the UK', ICEPT, p. 79, Woods and Bauen, 2003 <http://www.berr.gov.uk/files/file15003.pdf>

<sup>17</sup> 'N<sub>2</sub>O release from agro-biofuel production negates global warming reduction by replacing fossil fuels.' Atmospheric Chemistry and Physics, 7, 11191-11205. Crutzen et al, 2007. <http://www.atmos-chem-phys-discuss.net/7/11191/2007/acpd-7-11191-2007.html>

## Biofuels and land use

One of the key recommendations of the Gallagher Review is:

*'Current evidence suggests that the proposed EU biofuels target for 2020 of 10% by energy is unlikely to be met sustainably and the introduction of biofuels should therefore be slowed while we improve our understanding of indirect land-use change.'*<sup>18</sup>

This conclusion is based on the finding that the reduction in supply of US corn was leading farmers in other parts of the world to clear forests and grassland to replace the corn diverted to biofuel use.<sup>19</sup> Indirect land-use change has not previously been highlighted as a factor to consider in assessing the green credentials of the biofuel industry, but this problem is a recurring theme throughout the Gallagher Review. Seven of the eight main conclusions concern this issue, emphasising the review's belief that it is crucial it is addressed before irreparable damage is done to general perceptions of the industry's sustainability.

## Biofuels and rainforest destruction

Negative land-use changes are well-documented in relation to the biodiesel industry. While other sources such as oilseed rape and vegetable oil are more widely used at present, the proportion of global biodiesel supply produced from palm oil is rising. Attention has focussed on the origin of palm oil in particular and concerns expressed at how it is produced. A growing body of evidence suggests that carbon sinks such as peat bogs are being destroyed and tropical rainforest cleared to make way for palm oil plantations.<sup>20</sup> This result, arising from the desire of western governments to reduce carbon emissions from vehicles, has caused international consternation, and is another key factor in the reversal of public opinion towards biofuels. While only a fraction of world palm oil production finds its way into vehicle engines, the issue is emblematic of how commercial realities have derailed well-meaning environmental initiatives. Solutions to the issue are difficult to find as developing countries such as Indonesia and Malaysia seek to cash in on this new resources bonanza. The development of the Roundtable on Sustainable Palm Oil may help ensure environmentally protective palm oil production in problematic areas.

## The solution?

The problems discussed above relate to the use of so-called 'first generation' biofuels, whose commercial use as a fuel source has already been developed. Though these problems are undoubtedly serious, they do not totally undermine the green credentials of all biofuels. Despite its criticism the Gallagher Review calls for the existing policy to be amended, not abandoned. Alternatives exist in the form of 'second generation' biofuels which are produced from fibrous, or 'cellulosic', plant matter. This can include wood chips, straw, sweet sorghum and many others. Even algae can be used to produce biofuels, and crucially, none of these sources displace existing crops. The Gallagher Review recommends that future EU targets include a mandatory proportion of these second-generation fuels, but also notes that the technology is years away from 'commercial deployment.'

Biofuels offer a cure to a number of the world's ills but only when their commercialisation does not lead to adverse social consequences or negate their environmental benefits. Criticism of current biofuel policy is well-founded and should encourage concerted efforts to ensure that biofuel production results in the original benefits that were identified and have spurred growth.<sup>21</sup> The best solution to the industry's problems seems to lie with second generation fuels. It may be some time before these become commercially viable and governments should ensure that the impacts of their usage are better researched and mitigated than the current generation.

<sup>18</sup> The Gallagher Review, 2008. p.10

<sup>19</sup> 'Use of U.S. Croplands for Biofuels Increases Greenhouse Gases Through Emissions from Land-Use Change.' Science, Vol. 319. no. 5867, pp. 1238 – 1240. Searchinger et al, 2008 <http://www.sciencemag.org/cgi/content/abstract/1151861>

<sup>20</sup> New Scientist, Dec 2007

<sup>21</sup> The Roundtable on Sustainable Biofuels, established in June 2007, is dedicated to this aim.