



# BENTLEY AND THE FUTURE OF BIOFUELS



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## I. EXECUTIVE SUMMARY

In February 2008, Bentley Motors announced ambitious plans to embrace biofuels as part of a far-reaching environmental strategy.

The initiative comes as the automotive industry as a whole is accelerating the adoption of alternative fuels and new technologies, aimed at reducing CO<sub>2</sub> emissions and global dependency on fossil fuels.

International demand for fuel efficient, lower emission vehicles has mounted amid fluctuating oil prices and increased concerns about the impact of climate change. Several bodies and organisations have voiced their concerns over the sustainability of biofuels and the potential impact of land use, crop prices and food availability.

This paper aims to provide a balanced review of the key questions surrounding biofuels and how the strategy set out by Bentley relates to these.

Bentley is reassured by the conclusions of the Gallagher report, issued by the UK government, stating that there is a future for a sustainable biofuel industry. This report supports the need for sustainability criteria for all biofuels to ensure that they are produced in an ethical and environmentally sound manner.

The report recognises that there are some instances of natural habitats being destroyed to make way for palm plantations, impacting valuable carbon sinks and local biodiversity. However, mounting scientific evidence suggests that, when produced correctly, biofuels have a minimal detrimental effect on natural habitats.

Contained in this report is evidence that biofuels do not play a significant role in influencing the global price of food compared to the impact of fluctuating oil prices and increasing demand for food.

Bentley believe that bioethanol can become a truly sustainable, ethical energy alternative to fossil fuels. Examples of successful industries can be seen today in Brazil and Sweden.

There is still investment flowing into bioethanol projects, despite the recent slowdown in the global economy. These projects are helping to rejuvenate rural economies in the developed and developing world.

The report concludes by outlining the need for ethical sustainability criteria and calls for cooperation between governments, biofuel producers, NGOs and automotive manufacturers so that the benefits of biofuels can be realised on a global scale.

## 2. BENTLEY ENVIRONMENTAL STRATEGY

In February 2008, Bentley outlined a far-reaching environmental strategy for the luxury automotive group to be progressively implemented through to 2012.

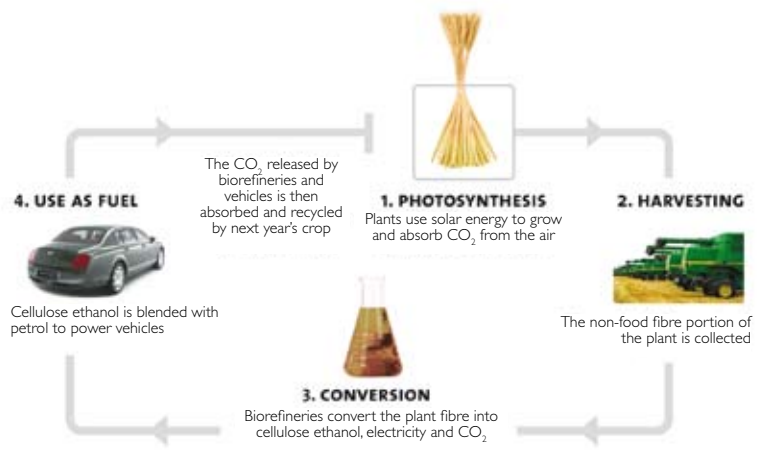
The commitments form part of a “roadmap” for Bentley to adapt our product portfolio in an era defined by climate change and the security of affordable fuel supplies.

Bentley are making the following commitments to address CO<sub>2</sub> emissions and fuel security concerns:

1. Bentley will take measures to reduce CO<sub>2</sub> emissions by at least 15% across our entire range by 2012. We will achieve this by applying improved technologies to current powertrains, introducing new transmission systems and drivelines, and reducing the weight of Bentley cars.
2. In a further measure, Bentley will introduce a new powertrain offering a 40% improvement in fuel economy by 2012.
3. Also by 2012, 100% of the range will be compatible with renewable fuels, delivering significant savings in CO<sub>2</sub> emissions.

Given the customer expectations of Bentley, an important factor of the strategy is that we deliver an improved environmental output without compromising the outstanding levels of performance and luxury, for which Bentley is renowned.

The renewable fuel solution will be based on the incorporation of FlexFuel powertrains – engines that can use either biofuel or petrol – into Bentley cars, dramatically cutting CO<sub>2</sub> emissions on a well-to-wheel<sup>1</sup> basis.



1. Well-to-wheel is the measurement of the CO<sub>2</sub> release of a fuel from its production ("well") to its combustion or deployment ("wheel"). Bentley believes that this approach – recognised by the UK government King review of Low Carbon Cars – is the most appropriate way to determine a fuel's net environmental effect.

### 3. MACRO-ECONOMIC CONTEXT

The future of biofuels is currently the subject of intense debate. Biofuel, as a class of fuels, is not well understood. A lack of public awareness creates a scenario in which positive examples of sustainable biofuel are often overshadowed by controversial issues. This negative press coverage then throws the viability of the whole industry into question.

Today's debate on biofuels is stimulated by a variety of commentators including global media, governments and independent organisations. In July 2008, the UK government contributed to this debate with the publication of a biofuel review by Professor Ed Gallagher, Chairman of the Renewable Fuels Agency.

Echoing several other reports, the Gallagher Review found that current policies on biofuel promotion could lead to net gains in greenhouse gas emissions, rather than savings, and potential negative consequences for biodiversity. Importantly, the review called for biofuels production to target idle or marginal land and for a greater emphasis to be put on developing second generation biofuels—those that utilise plant waste rather than requiring the food component of original crops.

There is evidence to suggest that the environmental impacts and the inefficiencies in biofuel production can be avoided through the appropriate biomass<sup>2</sup> source and production method.

The interest in biofuels has increased significantly amid unstable oil prices. At the same time, the cost of hydrogen technology and the impracticality of delivering hydrogen remain high. Recent research has cast into doubt the cleanliness of electric vehicles: the net CO<sub>2</sub> saving of these vehicles depends heavily on how the electricity is produced. A large percentage of power stations are driven by fossil fuels. These factors have encouraged several auto manufacturers to focus on a fuel source that can deliver performance with sustainability: Biofuels.

The future of the biofuel alternative clearly rests on being able to exploit the potential of this fuel source without compromising agricultural land use or exacerbating climate change. Bentley have therefore explored in this document elements of the debate shaping current attitudes to this fuel source.

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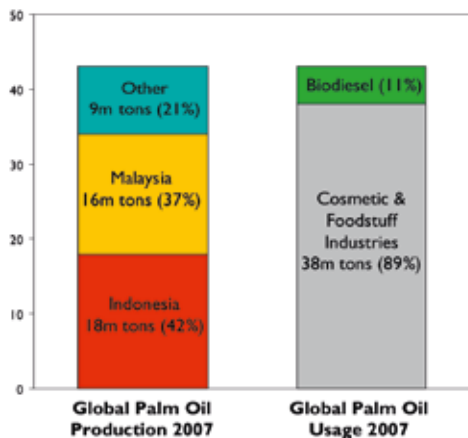
<sup>2</sup>. Biomass – organic matter that can be converted to biofuel

#### CASE STUDY:

##### Biodiversity vs. Palm Oil in Indonesia

Palm oil is one of the crops used when making biodiesel and is largely grown in Malaysia and Indonesia. Each year Europe imports around 2.7 million tons of palm oil to produce a range of products from soaps to cooking oils<sup>3</sup>. Friends of the Earth claim that the Indonesian great ape population is now endangered as rainforests are cleared for palm oil plantations<sup>4</sup>. The FoE report states that the Orang-utan population in Indonesia could be wiped out within 12 years if current trends continue.

In spite of claims of environmental groups that the Sarawak region of Borneo has been hit hard by logging, Peter Chin, Malaysian Minister for Plantation Industries and Commodities, highlighted that only 4% of the rainforest-rich province has actually been converted to palm oil plantations. He maintains that the agricultural industry is essential to support the local indigenous people.



The destruction of wildlife and natural habitats in South East Asia is a cause of concern. However, the vast majority of the Malaysian and Indonesian palm oil exported in 2007 was not destined for a biofuel refinery. 89% of the global palm oil output in 2007 was exported to the food and cosmetic industries. Only 5 million tons were refined into biodiesel.

## 4. CAN BIOFUELS BE PRODUCED WITHOUT HARMING THE ENVIRONMENT?

In order to grow so-called first generation biofuels – fuel derived from the sugar or starch-filled part of plants such as corn or sugar cane – large areas of arable land are required. There are three main environmental issues that currently face the biofuel industry:

- **Biodiversity:** effect of habitat destruction on native plant and animal species
- **Carbon sink destruction:** release of terrestrial CO<sub>2</sub> stores into the atmosphere
- **Displacement and exploitation of indigenous people**



### i. BIODIVERSITY

There are reports that the earth's natural habitats are being affected by an expanding agricultural frontier: environmental groups argue that vast areas of rainforest and peat land have been destroyed to meet growing demand for arable land. Reports from South America claim that rainforest is being cleared to make way for soya crops and fields for cattle grazing<sup>5</sup>. With the destruction of habitats comes a reduction in biodiversity. Environmental groups claim that ever more species of plants and animals are threatened with extinction as natural habitats dwindle.

**Bentley believe that it is important to maintain biodiversity throughout the world. However, as highlighted in the Indonesian case study, biofuel production is often not the main instigator of natural habitat destruction. Such criticism often distracts the public from the vast environmental benefits that can be made by using the fuel.**

3. Clover, C., 'Malaysia Defends Palm Oil Production', June 2007,

<http://www.telegraph.co.uk/earth/main.jhtml?xml=/earth/2007/06/10/eaoil110.xml>

4. International Fund for Agricultural Development 'Biofuel Expansion: Challenges, Risks and Opportunities for Rural People', February 2008

5. Webster, R., Taylor, M.: Friends of the Earth, 'European Commission – Climate and Energy Package', 2008

#### CASE STUDY:

##### Brazilian Bioethanol Success

Brazil, where sugar cane provides a vast proportion of automotive fuel, has shown that reduction in CO<sub>2</sub> and securing future fuel supplies does not have to be to the detriment of the environment. Over the last 3 decades, the Brazilian ethanol programme has been considered to be the benchmark for the global biofuel industry. Brazil has a mandatory minimum percentage ethanol and petrol blend. Petrol blended with 25% bioethanol (E25), more commonly known as gasohol, is available alongside E100 (100% bioethanol). **These fuels now provide more than 50% of Brazil's light vehicle fuel, however the sugar cane (from which it is made) occupies just 1% of its arable land<sup>11</sup>.**

In 2007, 71% of the cars manufactured in Brazil were "FlexFuel" cars – cars that can use E100 or E25 – a clear example of market demand<sup>12</sup>. The programme has boosted the economy through exports and helped create more than 700,000 jobs<sup>13</sup>.

There are many scientific reports confirming Brazil's environmentally friendly credentials: a Utrecht University report concluded that "no reasons were identified why [Brazilian] ethanol could not meet sustainability standards"<sup>14</sup>. Brazilian President Luis Inacio Lula da Silva is adamant that Brazil is doing all it can to prevent destruction of the Amazon rainforest. Due to the wet climate, it is difficult to grow sugar cane in the Amazon rainforest region; instead, the sugar cane plantations are situated on the plains North West of São Paulo and around Recife<sup>15</sup>.



#### ii. CARBON SINK DESTRUCTION

The natural habitats that have been most effected by crop frontier expansion are the rainforests, peat bogs and swamps. Due to their dense plant and wildlife population, these areas are considered as "Carbon Sinks"<sup>7</sup>. Carbon sinks are areas that contain large amounts of carbon that are terrestrially (not atmospherically) based and can range from oceans to forests and even areas of soil<sup>8</sup>. Such habitats absorb more CO<sub>2</sub> than they emit, thus helping to maintain the global atmospheric CO<sub>2</sub> levels.

When carbon sink areas are cleared to make way for crops – usually by burning – the carbon contained is released into the atmosphere. The Worldwide Wildlife Fund (WWF) estimates that turning one forest in Indonesia into a palm oil plantation is generating a net effect equivalent to 122% of the annual CO<sub>2</sub> output of the Netherlands<sup>9</sup>. There are already instances of carbon sink destruction: in Indonesia and Malaysia it is claimed that 14 – 15 million hectares of carbon-rich peat lands have been cleared to make way for palm oil crops<sup>10</sup>.

While this is true, it is important to remember that there are also positive examples of biofuel development elsewhere in the world – namely in Brazil. Sweden also has a very successful, environmentally friendly biofuel programme. The positive examples of biofuel successes are often overshadowed by misconceptions about their true ecological credentials.

**Bentley believe that the success of the biofuel industry in Brazil, both in terms of the vast savings in well-to-wheel CO<sub>2</sub> emissions (reported at 90% net well-to-wheel saving vs. petrol) and industry sustainability has the potential to act as a model for other countries. By harnessing the potential of biofuels, Brazil has also reduced its dependency on imported foreign oil, whilst having a minimal impact in its large areas of carbon sinks.**

**For the bioethanol industry to become credible and globally accepted by consumers, ecologically sound solutions – such as those on display in Brazil – need to be adopted by other producing nations. Consumers require a guarantee that their fuel is not irreversibly damaging natural habitats.**

7. Natural Environment Research Council, 'What are Carbon Sources and Carbon Sinks?', <http://www.nerc.ac.uk/research/issues/climatechange/carbon.asp>

8. Sedjo, R.A., 'Harvesting the Benefits of Carbon Sinks', 1998

9. World Wildlife Fund, 'Destruction Of Sumatra Forests Driving Global Climate Change And Species Extinction', Science Daily, February 2008

10. International Fund for Agricultural Development, 'Biofuel Expansion: Challenges, Risks and Opportunities for Rural People', February 2008

11. Car Magazine, 'Biofuels, we suck it and see', Issue 552, August 2008

12. Association of Brazilian Automanufacturers (ANFAVEA), <http://www.anfavea.com.br/tabelas2007/>

13. Lovins, A., Datta, E., 'Winning the Oil Endgame: Innovation for Profits, Jobs and Security', 2005

14. Smeets, Junginger, Faaij, Walter, Dolzan, 'Sustainability of Brazilian Bioethanol', 2006

15. Clendenning, A., Oakland Tribune, 'Brazil: Ethanol Farming will not Impact Amazon Rainforest', July 2007

#### CASE STUDY:

##### *Sustainable Ethanol Initiative*

*Sustainability criteria are vital in preserving natural habitats and to protecting the local population. There are several examples of such criteria, one of which is the Sustainable Ethanol Initiative. The initiative aims to provide verified, traceable, sustainable Brazilian bioethanol to the Swedish market.*

*The objective of the Sustainable Ethanol Initiative (SEI) is to promote sustainable and socially responsible Brazilian bioethanol in Sweden and ultimately help the European Union develop sustainability criteria for biofuels<sup>17</sup>. Such criteria have both an environmental and a social focus:*

- *A commitment to increase labour rights for biofuel plantation employees*
- *Improved working conditions at plantations*
- *Zero tolerance towards child labour*
- *Zero tolerance towards forced labour*
- *Zero tolerance towards rainforest deforestation.*

*The SEI aims to minimise humanitarian exploitation and displacement in the emerging biofuel industry through economic measures: they propose penalties be paid by producers for non-compliance with these criteria.*

*The first verified sustainable ethanol arrived in Sweden on 26th May 2008.*



#### iii. HUMANITARIAN IMPACT

Environmental groups argue that land used for agriculture expansion is often remote and home to indigenous people. Such habitats are often far from civilisation and hence are difficult for governments to regulate, making it easier for companies to clear habitats.

The purpose of clearing the land is often unclear; it can be due to expanding agricultural land (crops or cattle), or logging. Indigenous people are frequently affected by the destruction of natural habitats: Some environmental groups such as Greenpeace claim that “people cutting down forests in South America are slaves”<sup>16</sup>.

The chairperson for the UN Permanent Forum on Indigenous issues, Victoria Tauli-Corpuz, highlighted that approximately 5 million indigenous people in the Indonesian province of West Kalimantan were likely to be displaced by the expansion of the palm oil crop frontier.

However, there are studies that demonstrate the biofuel industry will have a positive impact on the world's poorest nations. Biofuel companies are investing in ventures in Africa, where optimum conditions for growing biofuels can be found. This investment has provided much needed funding for local infrastructure and amenities in the area.

**Bentley strongly believe that sustainability criteria, such as those set out by the Sustainable Ethanol Initiative should be key inclusions in future renewable fuel strategies of national governments. Such criteria do not adversely affect the competitiveness of biofuels against fossil fuels, and when executed and regulated correctly they are beneficial to emerging economies and their population.**

<sup>16</sup> [www.greenpeace.org/international/news/mcamazon-060406](http://www.greenpeace.org/international/news/mcamazon-060406)

<sup>17</sup> [www.sustainableethanolinitiative.com](http://www.sustainableethanolinitiative.com)



#### CASE STUDY:

##### Second Generation Biofuels in Africa

There are several examples of companies already beginning to tap into the potential of second generation biofuels in developing countries. With some of the largest areas of marginal land, the best conditions for photosynthesis (hence crop growth and yield) and an available work force, Africa is one of the areas that has the highest potential for a biofuel industry.

The Swedish biofuel company SEKAB has set up two initiatives, one in Tanzania, the other in Mozambique, with the aim of building a successful, sustainable biofuel industry that will provide economic benefits to the local population. With the strategy "Aid to Trade" (a play on trade), SEKAB hopes to lift 2-3 million Africans out of poverty, creating 400,000 to 600,000 new jobs with the help of 2 million hectares worth of sustainable, second generation bioethanol crops by 2025.



Pilot projects already in operation in Chipembe, Mozambique and in Bagamoyo, Tanzania, are utilising the good access to water and marginal land to produce ethanol and electricity. Bentley believes such projects are vital to the development of the global second generation biofuel industry that can deliver a sustainable, environmentally friendly and socially responsible source of energy. The trade opportunities can help improve developing local economies and lift people above the poverty line.

#### iv. BENEFITS OF BIOFUELS

There are major benefits of using biofuels as an alternative to fossil fuels:

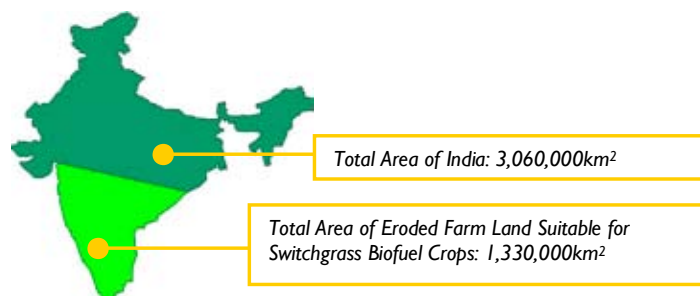
- Biofuels offer a **significant reduction in CO<sub>2</sub> emissions**
- Investment in biofuels often means **investment in agriculture**
- Biofuel plantations support **poorer rural communities** in developing economies

As with bioethanol made from sugar cane, biofuels made from non-edible plant mass (second generation fuels) are fast becoming a real alternative to fossil fuels.

There are some species of plant such as switchgrass and sorghum that can be used to make second generation biofuels. Such crops can be grown on marginal land on which traditional food crops cannot exist<sup>18</sup>.

The main advantage of using this marginal land for biofuel growth, aside from the fact that it has no impact on arable land and hence food production, is that vast areas of this scrub land are located in developing countries<sup>19</sup>.

A study by India's Ministry for Rural Development has highlighted the abundance of available marginal land. The study estimates that 43% of India's land mass could be used for growing switchgrass.



Growing biofuel crops not only brings environmental benefits, but also economic benefits for the local population. Biofuel crop plantations create jobs and boost local economies, allowing money to be invested in agriculture and amenities, helping the area to become self-sustainable.

**Bentley believe that when produced in an ethical and environmentally sound manner, biofuels can offer many more benefits than just providing low-carbon, sustainable fuel. Pilot projects in developing nations have provided investment in amenities and infrastructure, low cost energy sources, and trade opportunities for local economies.**

**Bentley would encourage the governments of the developed world to help develop such projects as they provide a win-win partnership for producers, end users and the environment.**

18. The Economist, 'Grow Your Own', 21st June 2008

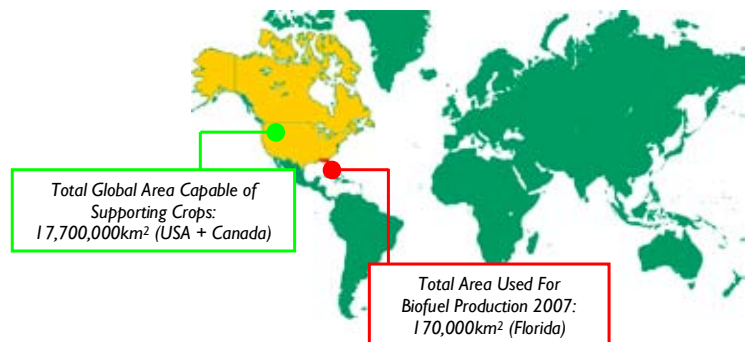
19. International Fund for Agricultural Development, 'Biofuel Expansion: Challenges, Risks and Opportunities for Rural People', February 2008

## 5. CAN BIOFUELS BE PRODUCED WITHOUT AFFECTING FOOD AND FODDER CROPS?

Much of the controversy surrounding biofuel is related to fears that production of biofuel will divert land use from food production. Recent increases in food prices have raised concerns about the impact of biofuel on land usage.

With a limited supply of arable land and an ever-growing demand for raw materials for food and fuel, there will inevitably be competition for land between biofuel and food crops.

**Contrary to common perceptions, the actual area of farmland used for biofuel crop growth is very small: biofuel crops take up only 0.1% of global land mass.**



Grain Harvesting

In the first half of 2008 food prices rose significantly causing politicians and media to scrutinize the fuel vs. food debate once more. Presidents Alan Garcia and Evo Morales of Peru and Bolivia accused biofuel development of “putting food out of the reach of the poor” and pillaging natural resources<sup>20</sup>. Many environmental and humanitarian groups also place the blame squarely on biofuels. Greenpeace state that biofuels are responsible for “driving up the price of basic foods”.

Indeed there is evidence that rising food prices have already begun to impact people in the world's poorer nations. Food riots have occurred in Egypt, the Philippines, West Africa and in Haiti. Officials in Pakistan have already begun to make raids on food hoarders. After seeing a 40% rise in the price of corn – the main ingredient for tortillas – thousands of people marched in protest in Mexico. In India, the 50% rise in food prices and consistently failing crops has led to widespread malnutrition in many rural areas<sup>21</sup>.

**The driver of the shortages is unclear. It is likely that the price rises are a combination of the following factors:**

- Increase in demand from **developing nations**
- Uncertainty in the global **energy markets and rising oil prices**
- Futures market **speculation**
- Inability of the **agricultural industry** to meet demand
- **Increased demand** for biofuel through incentives

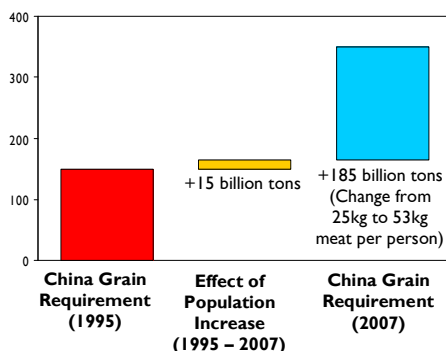
20. BBC News, 'Leaders Warn on Biofuels and Food', April 2008, <http://news.bbc.co.uk/1/hi/world/americas/7359880.stm>  
 21. [http://news.bbc.co.uk/1/hi/world/south\\_asia/7445570.stm](http://news.bbc.co.uk/1/hi/world/south_asia/7445570.stm)

#### CASE STUDY:

##### China's increasing food bill

Asia has seen rapid population growth in the past few decades, which is projected to reach 4.2 billion people by 2030. Economic growth has increased wealth in China, which has meant its inhabitants have had more disposable income, and Chinese dietary habits have changed accordingly.

In 1995, the average Chinese person consumed 55lbs (25kg) of meat, a figure that has now grown to 117lbs (53kg) in 2007, according to the UN Food and Agriculture Organisation. Taking into account the growth in population, it is estimated that China now requires an extra 199bn tonnes of grain to match the demand for meat – an increase of 232% since 1995<sup>27</sup>.



If similar population and wealth booms take place in other developing nations, the pressure to utilise land for food crops will increase.

#### i. INCREASED DEMAND FROM DEVELOPING NATIONS

Other sources highlight that the rise in food prices is due to an increase in demand. The President of the Brazilian Sugar Cane Association, Marcos Jank, suggests that increases in demand for food from developing nations have not been considered by those criticising biofuels for increasing food prices<sup>22</sup>. Increases from developing nations have been driven by two factors:

- Increase in population
- Increase in wealth

The world's population is projected to rise by 1% per annum in the next 25 years, adding an extra 1.75 billion people by 2030. Populations in developing countries have changed significantly in the past decade, and this has increased the global demand for food. India is predicting a population boom. Reports suggest that the number of people living in India will increase by 50% by 2050, adding an extra 3 billion people to the sub-continent<sup>23</sup>. This is largely due to the rise in living standards since the start of the country's economic development. As living standards, facilities and healthcare has improved, life expectancy has increased. Added wealth has also allowed the size of the average family to grow, further increasing the population.

A change in inhabitant wealth also alters eating habits: "As the wealth of an individual increases, so does their weekly food bill", stated Engel's Law<sup>24</sup> over a century ago. This reflects an ability of inhabitants to spend a greater amount of income on food. In today's terms it translates to an increase in meat intake<sup>25</sup>. Approximately 11lbs (5 kilograms) of grain are required to produce 2.2lbs (1 kilogram) of meat<sup>26</sup>. Therefore as preferences become more carnivorous, demand for fodder increases dramatically. So as wealth grows, food prices will rise.

**Bentley believe that the increase in oil prices, global wealth and population levels are having the most significant effect on food prices, not biofuel production. The trend of rice and soya prices is an upward one. These two food sources are not used for biofuel production on a commercial scale.**

**In order for the effect on food prices of a growing biofuel market to be minimised, a solution must be found that allows biofuel and food to be grown in unison. Hence, Bentley support investment in second generation biofuel research and pilot projects.**

22. Jank, M., 'Brazilian Ethanol Industry Developments: Sugarcane Ethanol Today and Tomorrow', Presentation to Conference on Sustainable Ethanol, Gothenburg, Sweden, May 2008

23. Blythe, N., BBC News, 'India's Big Population Challenge', February 2008, <http://news.bbc.co.uk/1/hi/business/7261458.stm>

24. Engel, E., 'Die Produktions und Konsumptions-Verhältnisse des Königsreichen Sachsen', 1877

25. USA Today, 'Global Demand Lifts Grain Prices, Gobbles Supplies', February 2008,

[http://www.usatoday.com/money/industries/food/2008-02-11-food-prices\\_N.htm](http://www.usatoday.com/money/industries/food/2008-02-11-food-prices_N.htm)

26. Lane, J., 'Meat vs. Fuel: Grain Use in the USA and China, 1995-2008', April 2008

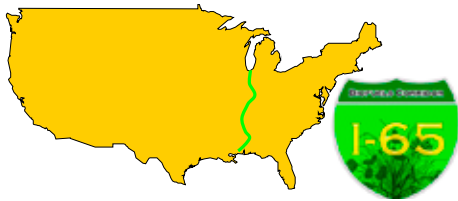
<http://www.biofuelsdigest.com/MeatvsFuel.pdf>

27. China grain requirement for meat production in 1995 was 150bn tons, population grew 9.8% during this period. Increase of meat intake from 25kg to 53kg meant grain requirement for meat production grew to approx 350bn tons per year.

#### CASE STUDY:

##### Biofuel growth in the USA

During 2008 the USA has seen a dramatic rise in demand for bioethanol. Rising energy prices – the threat of a \$5 gallon – and an increasing awareness of the environment, have meant sales of environmentally friendly vehicles have grown. Political weight has been thrown behind the push to make America green: In March 2008 President Bush urged Americans to “get off oil” to help provide a secure energy supply in the future and for the sake of the environment<sup>29</sup>. Political strategy has been reinforced by a biofuel mandate and CAFE guidelines to try and direct consumers and automotive manufacturers to greener fuels. This seems to be having an effect: on 7th October 2008 the first “biofuel corridor” along I-65 was opened with over 200 filling stations, making it possible to drive a vehicle on E85 from Lake Michigan to the Gulf of Mexico.



The election of Barack Obama is expected by many to signal increased support for biofuels. Illinois is America's second largest corn growing area and as its Senator, Obama has been a long-term supporter of using corn subsidies to encourage farmers to grow biofuels<sup>30</sup>.

The U.S. agricultural industry does have the capacity to replace a significant proportion of America's petrol requirement: a study by America's Department of Energy and Agriculture reported that with changes to production practices, 1.3 billion tonnes of plant matter could be collected for biofuels, without impacting food crops. This in turn would provide 92 billion gallons (350 billion litres) of bioethanol, or 65% of the country's current petrol consumption<sup>31</sup>.

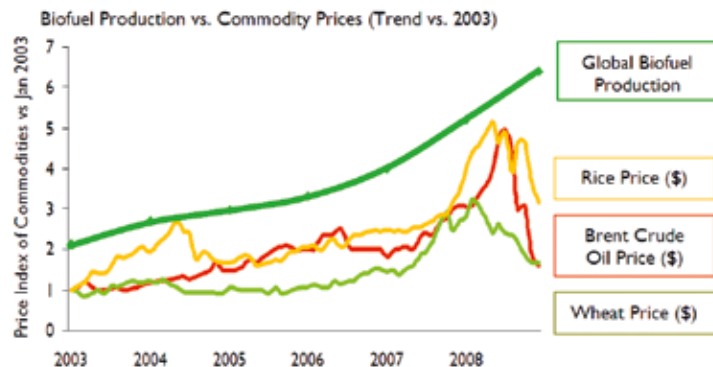
Bentley support efforts made by the U.S. government in encouraging investment in and usage of biofuels. Despite the issues over efficiency and food competition, Bentley believe that first generation bioethanol projects are the first step in adopting sustainable, renewable fuels. Such programmes are an essential first step in adopting alternative fuels. Without such investment the benefits of second generation biofuels may never be realised. By introducing alternatively fuelled cars over the next four years, Bentley is ensuring that our customers in the USA can reduce their dependence on oil and reduce their net CO<sub>2</sub> output.

#### ii. INCREASE IN BIOFUEL DEMAND

One method of promoting and increasing biofuel usage is for governments to offer subsidies or incentives to producers or distributors.

The U.S. farming industry has seen many of its farmers switch from traditional food to biofuel crops in 2007 and 2008. It is suggested that the switch to biofuel crops is due to an incentive issued by the U.S. government. This has resulted in an increase in demand for biofuel, making biofuel crops more profitable.

However, recent evidence suggests that this competition may be having a minimal effect on global food prices. Biofuel production in the USA has increased exponentially since 2000, with forecasts predicting total 2008 bioethanol production to reach 9.3 billion gallons – up 33% on 2007. But whilst biofuel production has continued to increase, food prices have fallen since their peak in summer 2008.



Food prices appear to have risen and fallen in line with the price of crude oil. Indeed, rice, a crop which is not used for biofuel production, has a price curve remarkably similar to wheat.

#### iii. UNCERTAINTY IN GLOBAL ENERGY MARKETS

Evidence exists that a rise in basic food prices could be attributable to a rise in production costs. Petrol and fertilizer are used in crop production, both of which are heavily dependent on the price of crude oil. This argument is backed up by EU Agricultural Commissioner, Marian Fischer-Boel, who indicated that only 1-5% of the cost of bread relates to the cost of the cereals used in its manufacturing<sup>28</sup>.

**Bentley agree that the rise in demand for bioethanol will lead to competition between food and fuel crops. Claims that rises in food prices are directly linked to increases in biofuel production are false. Higher food prices are more likely to be related to fluctuating oil prices.**

28. Speech by Marian Fischer-Boel, EU Agricultural Commissioner, May 2007

29. Speech by President George W. Bush to the Washington International Renewable Energy Conference, 5th March 2008, [www.whitehouse.gov/news/releases/2008/03/20080305.html](http://www.whitehouse.gov/news/releases/2008/03/20080305.html)

30. [http://www.barackobama.com/pdf/factsheet\\_energy\\_speech\\_080308.pdf](http://www.barackobama.com/pdf/factsheet_energy_speech_080308.pdf)

31. The Economist, 'Grow Your Own', 21st June 2008

#### CASE STUDY:

##### *Bioethanol incentives & mandates*

*Governments have begun to offer incentives for petrol producers to begin to use biofuel. The White House has offered a tax credit of \$0.51 to fuel producers in return for blending one gallon of bioethanol into ten gallons of petrol (approx €0.10 per litre).*

*The EU has proposed that the minimum biofuels market share in Europe should be 5.75% in 2010; however doubts have been cast over the validity of the proposal's environmental targets and assumptions. In January 2001 a group of UK politicians criticised the EU of subsidising first generation biofuels, stating that they were not the most efficient method of producing bio energy. Indeed, studies have shown corn-based bioethanol only produces 1.3 units of energy for every unit of fossil-fuel energy used in its production, whereas sugar cane produces 9 units.*

*This switch to second generation biofuels can produce between 2 and 32 units, depending on production techniques and would increase the potential yield of corn to 15,600 gallons (65,000 litres) per hectare.*

***Bentley agree with the Environmental Audit Committee and the Gallagher review – government policies should focus on encouraging growth in the second generation biofuel industry to further reduce competition between food and fuel crops. This should not halt the adoption of first generation biofuels as these help reduce net CO<sub>2</sub> emissions and dependency on oil.***

#### iv. BIOFUEL FUTURES SPECULATION

Some sources suggest that the low stock situation is causing unrest in the futures markets, which in turn cause a rise in food prices. Food futures are used by some farming cooperatives to “insure” themselves against a poor harvest. Helena Vines Fiestas, a policy advisor for charity Oxfam has called for an investigation into the markets and their role in the recent food price increases<sup>32</sup>. She stated that “Governments and international bodies...should commission a study to clarify the future markets’ contribution to the [food] price spike”. Similar concerns have been echoed in India as Finance Minister, Mr. P Chidambaram, proposed a halt to trading in food futures in May 2008<sup>33</sup>.

#### v. EXPOSURE OF AN INDUSTRY LACKING IN INVESTMENT

It is suggested that the inability of food suppliers to match demand could be a reflection of the decades of poor levels of investment in the global agricultural industry. A report by the UK Department for Environmental and Rural Affairs (DEFRA) concluded that recent price rises had possibly more to do with the low harvest yields than biofuel production<sup>34</sup>. The UN Food & Agriculture Organisation declared that there is an urgent need for developing nations to invest in agriculture to help alleviate the issues of unstable food prices<sup>35</sup>. The European Parliament reiterated this calling for a “substantial” increase in agricultural investment. A report highlighted the imbalance in investment and population spread: only 4% of global official development is dedicated to agriculture despite the fact that over 75% of the global population lives in rural areas<sup>36</sup>.

These comments imply that self-sufficiency of developing nations in terms of food provision could help stabilise and even reduce food prices in the future. It is foreseeable that once second generation biofuel processing techniques are industrialised, the ability to increase crop yields will substantially grow. In turn, this will enable developing nations to invest in agricultural industries allowing areas to become self-sufficient in terms of energy and sustenance.

Other analysts believe that low grain stock levels are due to a combination of improvements in “just in time” production techniques<sup>37</sup>. Just in time production minimises time that materials are stored before producing goods, saving companies considerable costs. However, as stock levels are based on historical trends, it is difficult for the system to adjust if demand suddenly rises.

**Bentley believe that the development of second generation biofuels could help regenerate an underperforming global agricultural industry and allow developing nations to become self sufficient, providing affordable, secure sources of food and energy for local populations.**

32. Mackinlay, R., ‘Oxfam Calls For Investigation Into Futures Markets’, May 2008, <http://www.investigate.co.uk/in/article.aspx?id=18649>

33. Minder, R., Financial Times, ‘India Considers Ban on Trading in Food Futures’, May 2008

34. DEFRA, ‘Biofuels: Risks and Opportunities’, October 2007, <http://www.defra.gov.uk/farm/crops/industrial/energy/pdf/biofuels-risks-opportunities.pdf>

35. UN Food and Agriculture Organisation, ‘Food Summit Calls for More Investment in Agriculture’, June 2008, <http://www.fao.org/newsroom/en/news/2008/1000856/index.html>

36. European Parliament, ‘Soaring Food Prices: Investment in Agriculture Needed in Developing Countries’, May 2008, <http://www.europarl.europa.eu/news>

37. Kirchhoff, S., USA Today, ‘Surplus US Food Supplies Dry Up’, May 2008, [http://www.usatoday.com/money/industries/food/2008-05-01-usda-food-supply\\_N.htm](http://www.usatoday.com/money/industries/food/2008-05-01-usda-food-supply_N.htm)



#### CASE STUDY:

##### Biofuel industry in Sweden

Sweden only embraced the biofuel concept in 2005. Then Prime Minister, Goran Persson, declared that Sweden would be free from oil dependency by 2020. Since then the biofuel industry has flourished in the Scandinavian country. Companies such as SEKAB, Lantmännen and BioGasol have already set up first generation bioethanol plants in Sweden, which use biomass from woodchip and wheat. These have fuelled a boom in FlexFuel vehicles and availability of bioethanol. It took 10 years to open the first 100 bioethanol filling stations in Sweden, the last 100 opened in just three months. The Bio Alcohol Fuel Foundation (BAFF) predicts that the Swedish FlexFuel vehicle market share could exceed 40% as early as 2010, and that the volume of E85 fuel sold in the country will more than double to over 300 million litres p/m by July 2009<sup>38</sup>.



Abengoa Dual Generation Bioethanol Plant, Salamanca, Spain

## 6. CAN BIOFUELS BECOME A COMMERCIALLY VIABLE CONCEPT?

It has been highlighted by the cases in Brazil, USA and Sweden, that biofuels can be a commercially viable alternative fuel that can go some way to replacing petrol.

Across Europe bioethanol refineries funded by a variety of industries from petrochemical concerns to sugar producers have started operation. Crop Energies, based in Sachsen-Anhalt, Germany, operates the largest first generation bioethanol plant in Europe whilst Abengoa already has several bioethanol plants across Europe and the United States.

In spite of current unfavorable market conditions, investment in second generation bioethanol projects is continuing. Trial projects led in Europe by organisations such as ebio (European Biofuel Organisation)<sup>39</sup>, the NILE project<sup>40</sup> and BAFF<sup>41</sup> are the first step in bringing a commercial scale second generation biofuel solution to market. Volkswagen group is currently active within the biofuel sphere and is in partnership with industry-leading bioethanol producer logen. logen have a facility in Canada which is already capable of producing second generation bioethanol on an industrial scale. The company has already demonstrated this by delivering a significant volume of second generation biofuel in 2008.

Indeed, investment in innovative ideas is no longer on a small scale: large pharmaceutical and energy companies are researching new sustainable biotechnologies in-house as well as funding projects at universities<sup>42</sup>.

As the technology that supports biofuels develops, the price of E85 is expected to fall. Projections forecast the cost of producing second generation bioethanol to fall up to 75% between 2005 and 2030. This will bring E85 into line with the current cost of producing petrol.

The full environmental benefits of biofuels can only be achieved by maximising their usage. As seen in the USA and Sweden, government subsidies play a major role in nurturing the biofuel industry. There are various methods used to achieve this: the Swedish government offers over €500 per cubic meter of bioethanol as an incentive for producers, whereas in Germany, distributors are heavily penalised if bioethanol is not blended into petrol.

As indicated above, the transition from first to second generation biofuels will be gradual. Biofuel producers are already working to facilitate this steady change by building refineries capable of producing first and second generation bioethanol using the same equipment. Biofuel producer Abengoa is currently investing in two such plants capable of producing both generations, one in Kansas, the other in Spain.

**There is evidence that proves biofuels can become a commercially viable concept. Considering the current economic climate, Bentley believe that in order to support and develop a global sustainable biofuel market, governments should continue to incentivise biofuel projects now.**

38. Carstedt, P., 'Vulnerability of the Transport Sector and the Development of Sustainable Ethanol for Sustainable Transport Systems', Presentation to Conference on Sustainable Ethanol, Gothenburg, Sweden, May 2008.

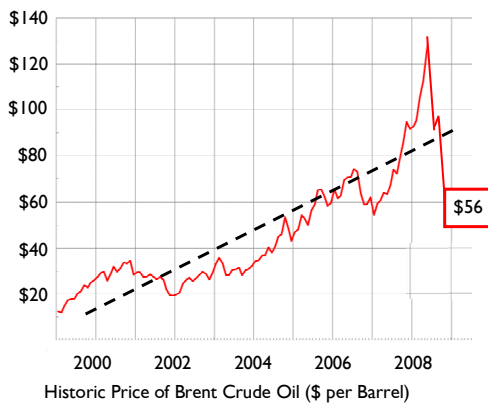
39. [www.ebio.org](http://www.ebio.org)

40. [www.nile-bioethanol.org](http://www.nile-bioethanol.org)

41. [www.baft.info](http://www.baft.info)

42. The Economist, 'Grow Your Own', June 2008

## 7. HOW CAN THE BENEFITS OF BIOFUELS BE REALISED ON A GLOBAL SCALE?



As this document has made clear, questions remain about the ethical and environmental credibility of biofuels in the public domain. However, **there is a pool of persuasive evidence which demonstrates that biofuels can have a positive impact on the environment and developing economies.**

Volatile oil prices reflect the drastic need for alternative, sustainable fuels. With supplies rapidly drying up, and demand steadily growing, the upward trend of fuel prices will continue. Climate change is a very real threat and failure to act by governments, international agencies, industry and consumers would pose a very serious global threat.

Biofuels, initially seen as a very important solution, have recently been characterised as part of the threat. **But this document shows that biofuels can be produced without harming the environment.** There is sufficient marginal land on which to grow second generation biofuels so that natural habitats and carbon sinks remain intact.



E85 pump at gas station, Madrid, Spain

There are already examples of biofuels working on a national scale: Brazil and Sweden both have flourishing biofuel industries, bringing environmental benefits along with a reliable, secure source of energy. Economic benefits are also starting to be realised from these industries: foreign investment in Brazilian biofuel companies is growing by the day and second generation cellulosic bioethanol pilot projects are already driving a fledgling industry in Europe.

**It is untrue that a rise in demand for biofuels has been the main reason for increasing food prices.** It is clear, however, that other factors played a significantly larger role. Developments in second generation biofuels will enable food and fuel crops to be grown without competing with each other. For biofuels to become a truly alternative fuel, sustainability criteria which minimise the social and environmental impact must be implemented on a global scale.

**In order for the biofuel industry to prove its ethical credentials, traceability and sustainability criteria must be put in place. It has been proved by a variety of projects around the world that bioethanol can be produced sustainably on a commercial scale. In ensuring the sustainability of such fuels, the development of second generation fuels can only bring further benefits that eclipse any current disadvantages.**

**Bentley believe that through cooperation of automotive manufacturers, biofuel producers, the global agricultural industry and governments, bioethanol can become a truly sustainable alternative to fossil fuel usage in the near future.**

## 8. HOW IS BENTLEY ADOPTING SUSTAINABLE FUELS?

In addition to improving the efficiency of our vehicles, Bentley reviewed a number of alternative technologies to support our product-based environmental strategy. After considering a variety of alternative technologies, Bentley decided that FlexFuel provided the most suitable platform around which to base our future core model line up.

Bioethanol combines impressive CO<sub>2</sub> savings, is compatible with existing infrastructure and is capable of delivering the performance levels for which Bentley is renowned. It has the potential to deliver significantly better CO<sub>2</sub> savings on a well-to-wheel basis than cars powered by hydrogen or electricity for many years to come.

By delivering bioethanol FlexFuel technology from 2009, Bentley is creating the ability for greater CO<sub>2</sub> savings to be made once sustainable second generation bioethanol becomes more widely available.

Bentley is making a significant investment to enable our entire fleet to operate on biofuel whilst maintaining the character and level of performance expected by our customers. The transition from a petrol to a FlexFuel powertrain is not simply a case of flicking a switch. Bioethanol has a different chemical make-up, and hence characteristics, from traditional petrol. With its high level of octane, bioethanol can deliver high performance, however due to its lower energy content, flow rates of fuel into the engine have had to be increased by 30%. As bioethanol does not have the same lubrication characteristics as petrol, Bentley have upgraded materials used for parts directly in contact with the fuel. New fuel tanks, seals, gaskets and fuel pipes have been re-engineered to deliver high performance levels using both petrol and bioethanol.

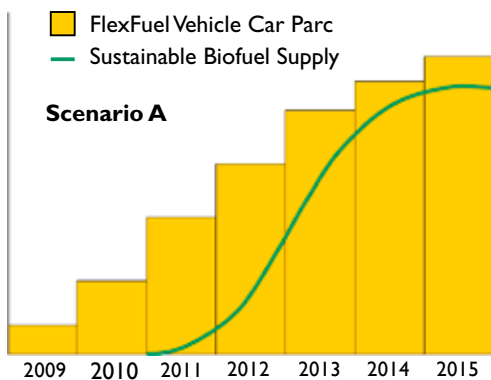
FlexFuel technology allows the customer to use any mix of bioethanol from 0%- 85%, enabling them to choose the most environmentally friendly fuel at their convenience. This requires a complete recalibration of the engine management system and the addition of fuel sensors that adjust how the engine runs according to the amount of bioethanol in the car's tank.

The drivetrain must undergo recalibration and a validation programme using both petrol and E85. This includes trials in extreme hot and cold climates, and in excess of 1 million miles of vehicle testing.

**The investment in engineering is proof of Bentley's commitment to offering a full range bioethanol compatible vehicles before 2012. Engineering work is already underway and is on target to deliver FlexFuel vehicles across our fleet, with the first variant available in 2009.**

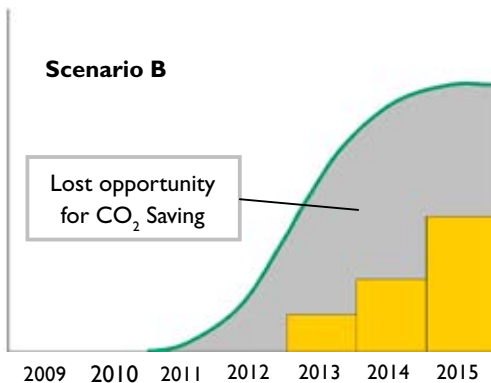


## 9. SHOULD WE ADOPT BIOFUEL TECHNOLOGY NOW OR WAIT UNTIL SUSTAINABILITY CRITERIA ARE ESTABLISHED?



Various lobby groups have argued that the widespread adoption of biofuels should be delayed until they are satisfied that effective sustainability criteria have been established and are capable of audit. In the UK this has had the effect of preventing Government from favouring biofuel compatible vehicles – the way they have done for other low tailpipe CO<sub>2</sub> technologies.

In the long term this is damaging the impact that biofuels will have on CO<sub>2</sub> reductions when sustainability criteria have been established. By encouraging consumers to buy biofuel compatible vehicles today they will be building a fleet of vehicles capable of delivering a steep change in CO<sub>2</sub> reduction when the supply of biofuels increases. This will have the additional benefit of improving the viability of the emerging biofuel industry and increasing the levels of investment.



Scenario A highlights the need to build a FlexFuel capable fleet before biofuel becomes widely available. By doing so, the CO<sub>2</sub> savings are maximised, limited only by the supply of bioethanol into the market. Scenario B highlights the potential risk to CO<sub>2</sub> savings if FlexFuel vehicles are built after sustainable biofuel becomes available. The grey area underneath the sustainable bioethanol supply curve highlights the lost opportunity for CO<sub>2</sub> saving due to the lack of FlexFuel vehicles in the market to take full advantage of the supply.

**Bentley believe that producing cars capable of running on biofuels now will maximise the potential net CO<sub>2</sub> saving of our car parc in the future. Even in areas where biofuel is not yet on sale, these cars will enable our customers to immediately change from petrol when E85 becomes available in their locale.**

## 10. CONCLUSION



Bentley intend to press ahead with an environmental strategy based on biofuel and new engine technologies.

The company has been reassured by the recommendations of the Gallagher Review, which has highlighted that there is definitely a future for a genuinely sustainable biofuels industry, provided mandatory sustainability criteria are implemented<sup>43</sup>. Bentley believe that these measures should be integrated sooner rather than later to ensure the momentum of biofuel investment is not lost.

This solution will allow Bentley to balance the high levels of performance that define the marque and balance our responsibility to mankind and the environment with our responsibility to the local population and economy. On a wider scale, Bentley has a positive effect on the UK and EU economy as an employer and exporter. Securing the relevance of its products is fundamental to its future success.



Inaction is not an alternative. Substantial investment in biofuel infrastructure and FlexFuel cars is required now to give consumers access to sustainable, environmentally friendly travel. First generation biofuels are an essential first step in maximising CO<sub>2</sub> savings and also help fund the technological developments to enable a commercial-scale introduction of second generation biofuels. Building a FlexFuel capable fleet now will maximise the environmental step change when sustainable biofuel becomes more widely available.

**Bentley believe that through cooperation of automotive manufacturers, biofuel producers, the global agricultural industry and governments, bioethanol can become a truly sustainable alternative to fossil fuel usage in the near future.**

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43. Gallagher, E., 'The Gallagher Review of the Indirect Effects of Biofuels Production', July 2008





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