

## Theme # 10 – World Market for Biofuels

### **WORLD MARKET FOR BIOFUELS**

*An acceptable – and positive impact*

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#### 1. Introduction

The demand for biofuels is growing enormously. From the evidence available today, we believe that biofuels could, with developments in technology and favourable policy constitute up to 30% of the world transport fuel mix by 2030.

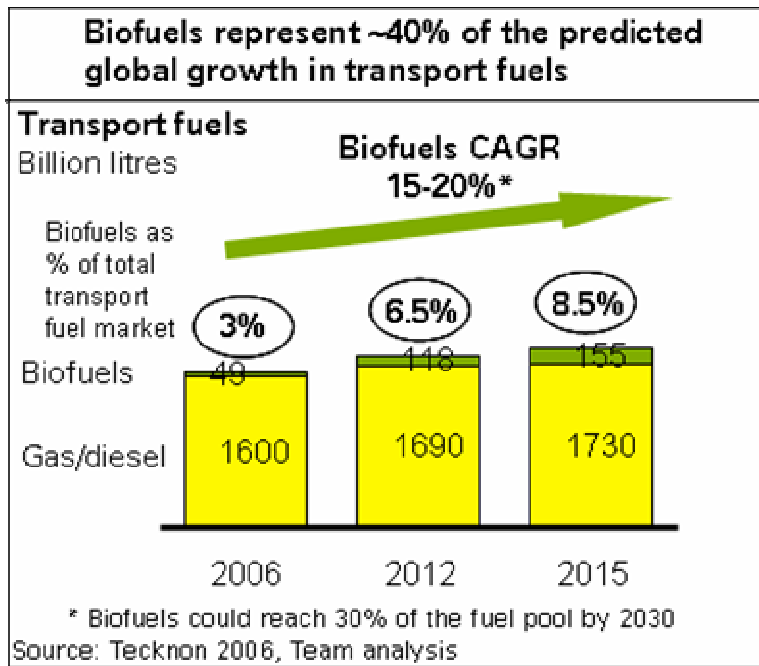
The advantages of biofuels – whether in greenhouse gas benefits, energy security or rural development-mean that many governments are keen to foster the industry through current phases of technology development to deliver material scale and reduced costs.

Our belief is that the industry can be developed sustainably, provided appropriate feedstocks are grown, which do not adversely compete with food, using good land management to minimise environmental impact. This will require development of appropriate sustainability standards; it will not be easy, but by engaging in the industry, responsible businesses will work out appropriate business models and want to see enforcement of standards across the industry.

This paper sets out the characteristics of the global fuels market, the significance of joint industry studies with car manufacturers and the choices around land use that society must make. The approach taken by BP is then described whereby guiding principles have been defined to set the boundaries of our impact on ecosystems.

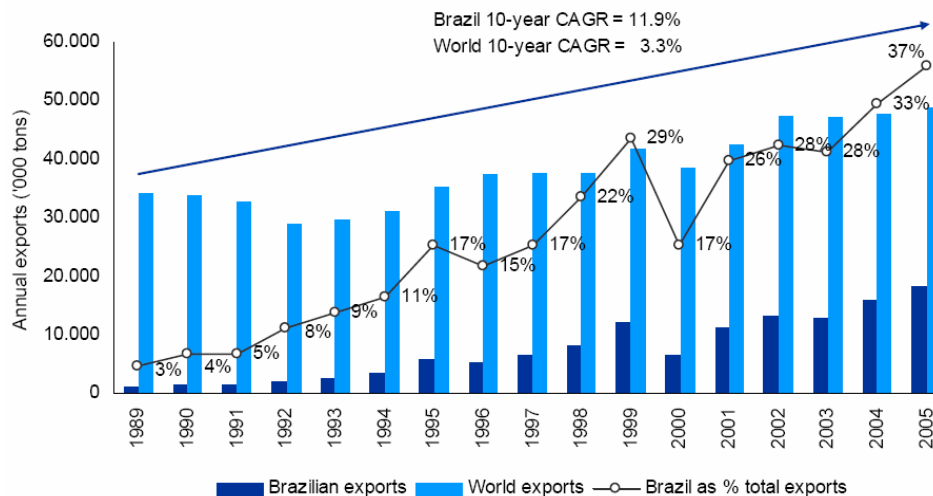
#### 2. Characteristics of the biofuels market: its size and growth rate

The world is in a state of biofuels fever. In 2006 biofuel constituted 49 bn litres, or 3%, of the 1,600 billion litre market for gasoline and diesel fuel. By 2015 the biofuels market is likely to have tripled to 155 billion litres.



**Fig 1: Projected increase in demand for biofuels**

This equates to a compound annual growth rate of around 15-20%<sup>1</sup>. This significantly outpaces historical growth, including the steep growth of the Brazilian sugar industry.



**Fig 2: Historical growth of Brazilian sugar exports<sup>2</sup>**

In practical terms that is an increase of around 10 billion litres per year over ten years. In terms of current ethanol yields of 5,250ltrs / ha, this equates to an increase of land use for biofuels of approximately 17,000 square km per year.

The bulk of the global demand for ethanol and biodiesel comes from a few major regions. The USA accounted for very nearly 50% of global ethanol consumption in 2006, with Brazil taking 36% of global volumes. The EU accounted for 75% of global biodiesel consumption in 2006.

<sup>1</sup> Analysis of data from Tecknon 2006

<sup>2</sup> Source: Itau Corretora – Sector Report, Ethanol and Sugar

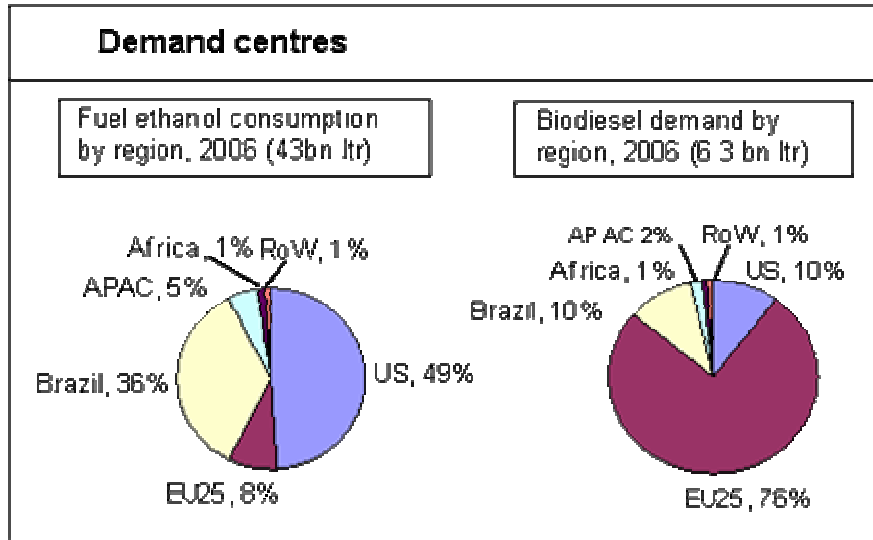


Fig. 3 Demand by region

The reason why we believe the feverish rate of growth is likely to materialize is because, with no carbon beneficial substitutes available in the near term, biofuels are being promoted by governments. Clear examples of this are the trends of regulations in the EU, and the intentions announced in the US.

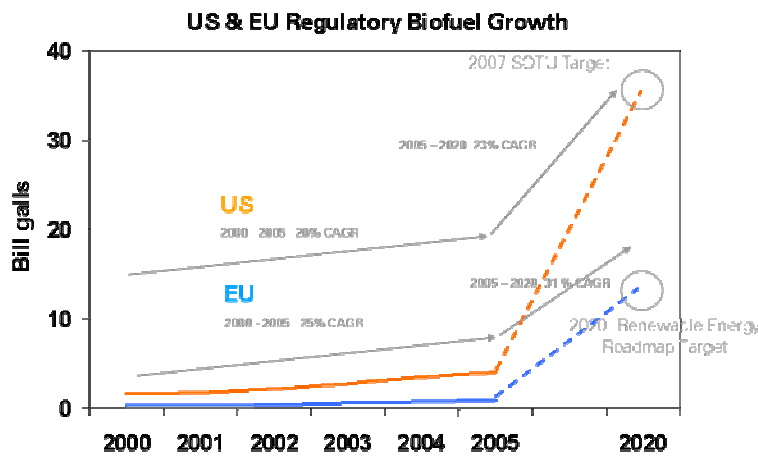


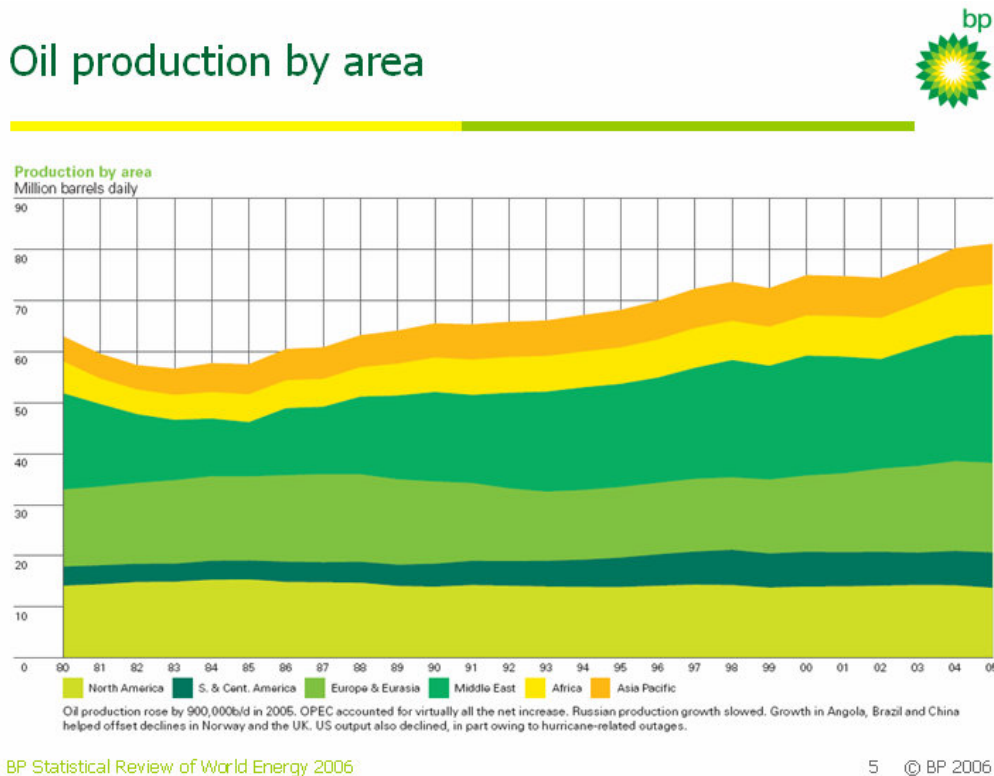
Fig 4: Regulatory demands push growth

BP is already a major player in the global biofuels market. In 2006 BP blended 3,016 million litres of ethanol into gasoline – a 25% increase on the previous year. Thus BP is already well exposed to the biofuels fever – and the theme of this paper is to suggest how the industry can tap the heat of the fever in a positive sense.

### 3. Supply of fossil fuels

Known reserves of oil and gas would provide at least 100 years of production at current rates and the growth of global production of fossil oil and gas is modest;

for instance, between 2004 and 2005 production increased by 1%<sup>3</sup>. Further reserves are, however, becoming harder to access, both politically and technologically.



**Fig 5: Fossil fuel oil production by area**

For instance the technologies for squeezing oil from tar sands, as being developed in Canada, or for gas-to-liquid conversion, are more expensive than traditional techniques of extracting oil. We believe that the net effect will be to drive up fossil fuel prices. However, short term fluctuations have characterised the oil markets – and this upward trend might only be evident after many years.

Increased fossil fuel costs will create opportunities for alternative fuels and in particular allow biofuels, over time, to compete better in the market for liquid transport fuels.

#### 4. Strategies for developing the biofuels market

The current phase of development of biofuels is driven by governments which have recognized the triple challenges of climate change, energy security and rural development. The significance of this phase, compared to the rapid phase of development of ethanol in Brazil in the 1970s, is that the issues are now global. Incentives or mandates for biofuels are being developed across the world from Europe to New Zealand, as well as in China, Southern Africa and Indonesia for instance.

<sup>3</sup> BP statistical Review  
[http://www.bp.com/liveassets/bp\\_internet/globalbp/globalbp\\_uk\\_english/reports\\_and\\_publications/statistical\\_energy\\_review\\_2006/STAGING/local\\_assets/downloads/pdf/table\\_of\\_world\\_oil\\_production\\_2006.pdf](http://www.bp.com/liveassets/bp_internet/globalbp/globalbp_uk_english/reports_and_publications/statistical_energy_review_2006/STAGING/local_assets/downloads/pdf/table_of_world_oil_production_2006.pdf)

Different players in the biofuels industry are likely to have many strategies. We can imagine two fundamental strategic options: “watch and wait” which reacts to the mandates for biofuels; or “drive the market” where investments are made to enable taking a better competitive position in a growing industry. BP has not adopted the “watch and wait” strategy; instead we want to ensure our business meets the changing needs of our customers and stakeholders – be they motorists at the pump or government partners with whom we work to develop oil businesses.

The demand for biofuels is not just a desire of policy makers, but is reflected in surveys of the general public – the consumer. Of the Europeans surveyed, 47% say they would be prepared to pay more for a vehicle that ran on biofuels, and 41% would be prepared to pay a little more for biofuels.

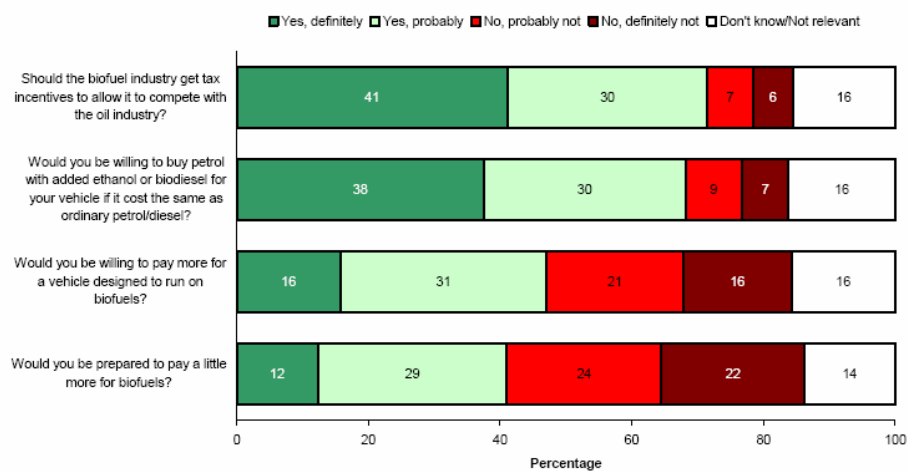


Fig 6: Opinion poll data on European Citizens' attitude to Biofuels<sup>4</sup>

BP's strategy has involved the formation of a dedicated business unit to pursue opportunities across the value chain from accessing feedstock, through conversion to trading and marketing. The actions we are taking, and the boundaries within which we are operating to ensure sustainability, are described later in this paper.

### 5. Joint industry studies of the market for biofuels

BP participated with other leading companies in the oil and car industries in an extensive study<sup>5</sup> into Sustainable Mobility.

The table below shows data extracted from the International Energy Agency mobility model for a reference case of increased mobility demand with current fuels and vehicle efficiencies.

<sup>4</sup> See Figure 9 of Eurobarometer survey:

[http://ec.europa.eu/research/biosociety/pdf/eb\\_64\\_3\\_final\\_report\\_second\\_edition\\_july\\_06.pdf](http://ec.europa.eu/research/biosociety/pdf/eb_64_3_final_report_second_edition_july_06.pdf)

<sup>5</sup> WBCSD Sustainable Mobility: <http://www.wbcd.org/web/publications/mobility/mobility-full.pdf>

**All Road Transport - IEA MoMo Model Reference Case**

	OECD			non-OECD			World		
	gasol	dies	TOTAL	gasol	dies	TOTAL	gasol	dies	TOTAL
2005 (bn litres/yr)	806	402	1208	336	274	610	1142	676	1818
2030 (bn litres/yr)	911	559	1470	774	541	1315	1685	1100	2785
Change (bn litres/yr)	105	157	262	438	267	705	543	424	967
Change (%)	13.0	39.1	21.7	130.4	97.4	115.6	47.5	62.7	53.2

**Table 1: Reference case model of increase in global fuel demand**

This shows that within the next 25 years, we expect a 50% increase in fuel demand driven by growth in demand for mobility. This already takes into account anticipated improvements in vehicle fuel efficiency (2% every 5 years in OECD and 3% every 5 years in most other world regions - a 10% reduction by 2030 in OECD and 15% elsewhere).

Data from a leading car manufacturer shows that to improve fuel economy by 33% (which corresponds to eliminating the additional fuel required through a 50% increase in mobility demand) would cost about US\$5000 per vehicle in Europe, and about US\$2000 per vehicle in the US.

If biofuel blends by 2030 were around one third of fuel content (by energy), then that would enable the increased mobility to be achieved whilst maintaining fossil fuel demand at current levels.

There is a real challenge about the regional distribution of the demand - as the table above shows, most of the growth in fuel requirements will come in non-OECD regions, or in diesel fuels.

So a combined approach - vehicle efficiency 10% better than in the reference case (ie., 20% better than today in OECD and 25% better in non-OECD) combined with 25% biofuels by 2030 would achieve the same outcome - ie maintaining fossil fuel demand at current levels.

Alternative vehicle power systems (eg hydrogen fuel cells) are unlikely to fill the market in mass production quantity over the next two decades because the necessary technology and the infrastructure changes will not be available.

Motor manufacturers are making significant progress in fuel efficiency through lighter weight cars, the transition to diesel engines and internal combustion/electric hybrids. None of these developments preclude a growing role for biofuels.

These findings lead us to believe that biofuels will be driven to meet 30% of the world's liquid transport fuel needs by 2030.

Thus another way of characterizing the global market for biofuels is that the demand is "good for all seasons". Our challenge is to ensure that the products are as beneficial for the motorist as possible yet meet the environmental objectives expected of them by governments and society at large.

If we are not to ration mobility, biofuels are our best bet.

## 6. What does society want?

In BP we recognize global objectives for biofuels such as the fight against climate change, ensuring security of energy supply and stimulating rural development. However, these drivers do pose questions of complex trade-offs; how much land can be adapted to biofuels growth to ensure GHG emissions are lowered? Can we define an acceptable level of risk to biodiversity if a field is used to cultivate sugar rather than being left as pasture?

The mood of the general public has to be reflected by the political decision making process. It is governments, whether regional or national, which determine the strategy for tackling climate change or the right way of preventing agricultural decay in developed economies, or stimulating agricultural potential in the developing world. Our role, as a business, is “operational”; we use resources efficiently to meet customers’ needs. We strive for mutual advantage between business and society. In our view, if biofuels, are developed in the “right way”, they can tap the growing wave of societal and political energy and be part of the solution to providing the energy people need in a way that is beneficial to the planet.

This paper recognizes that any change of land use can affect an ecosystem – virtually by definition, since humans are part of ecosystems. The question is “What impact is acceptable?” Or in other words “How can we make the most effective use of land and natural resources for farming, people and animals?”

There is much work involved in design of verification systems that allow transparent selection of the biofuels with optimum GHG benefits. It is not easy to institute systems that are sufficiently rigorous yet practical. However, with sufficient input by those who will have to operate these systems, and mindful of the costs and complexity we are confident that the different certification camps will coalesce in a pragmatic way, to adopt similar techniques for different crops and enable biofuels with higher GHG benefits to be better rewarded in the market. Such reporting will for example enable society to choose whether irrigated corn grown with high fertiliser inputs and converted to ethanol in coal fired plants is acceptable when compared with ethanol based on rain fed sugar where the bagasse is harnessed for power.

However, it is much more complex for society to judge and then decide whether landscape change of the magnitude shown below is acceptable.



Fig 7: Industrial scale cultivation<sup>6</sup>

## 7. Practical steps: harness creativity to move forward the right way

We doubt that anyone has all the answers as to how to develop the biofuels industry sustainably given the wide range of feedstocks and industrial conversion processes, and economic and political pressures.

BP would like to ensure that the biofuels industry, as it expands globally, and continues to grow at more than 15% per annum, adopts the precautionary principle. Given the scale, and the move into countries that may have little experience of biofuels production or weak governance structures to regulate agriculturally extensive industries, all those involved need to think through the consequences carefully, especially the potentially unintended ones.

The push for biofuels presents potential business opportunities, but also places significant demands on us. Targets in Europe and the USA require us to supply substantial volumes of bioproduct now. This is before accepted certification and verification systems for sourcing feedstocks or accepted norms for either verifying or specifying the GHG benefits of particular production chains have been established.

For the industry to fulfil the demands being placed on it, oil companies like ours cannot be limited simply to thinking; we need licence to experiment. Business must be motivated to deploy its creative capacity and its capital to build biofuels production capability, it must not be constrained by pre-determined solutions. The industry will have to explore the unknown – and take some measured risks – to see what works best.

We believe that this experimentation must occur within the boundaries of a set of guiding principles. The industry, in consultation with other stakeholders, can determine what works best. Once appropriate standards have been defined, responsible players can compete – offering a product that customers will buy in a manner that will not compromise future generations.

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<sup>6</sup> Photograph taken from paper presented by Prof Donato Aranda to Royal Swedish Academy of Sciences, February 2007

Since the standards and certification requirements have to relate to what is acceptable in different parts of society we must first lay out the basic principles as a foundation. Some principles will be universally accepted – for example, the social requirements embodied in the UN charter on human rights. Other principles will recognize the need for debate and lead to different solutions for different places. For instance, is it acceptable to produce biofuels with sub-optimal GHG benefits in the near term, if they promote rural development and so enable the capability to harvest highly carbon efficient ligno-cellulosic feedstocks in the future?

#### 8. Development of guiding principles – what BP is doing to manage its impact

We in BP welcome the opportunity to talk publicly about our guiding principles. Our biofuels business is at an early stage of development; we wish to define a set of underlying principles that lead to generally acceptable impacts from biofuels which can be voluntarily adopted by the major responsible players. Subsequent regulation will be necessary, but we believe that over time, transparency and public scrutiny will drive the whole industry to sustainability in environmental, social and economic terms.

Market forces can then reward innovation and ensure competitive pricing.

#### 9. Understanding, communicating and regulating our impact

BP is taking action in three ways:

- Understanding current practicalities and future possibilities

In 2005 we initiated a jatropha project with The Energy Research Institute in India to plant 8000 ha with *Jatropha Curcas* to understand its yield, soil and water requirements and overcome any barriers to commercial use as a feedstock for biodiesel.



Fig 8: Jatropha nursery, Andhra Pradesh, India

This is a practical route to assessing the relative impact on ecosystems of a key potential alternative to palm and soy, whose cultivation can compete with other crops that require fertile, well watered soils. For example, one of the elements of research is to understand the relative effect of plantation type with intercropping, boundary and block plantations being tested.

In 2006 BP announced a partnership with Dupont to manufacture biobutanol. This is a superior fuel molecule to ethanol, with an energy content that is approximately 25% higher. It will be tested in the market in late 2007. The intention is that it will be produced from sugars and starches currently available, but in time also from ligno-cellulosic feedstocks – thus minimizing impact on ecosystems, as well as minimizing volumes of biofeedstock that require to be transported.

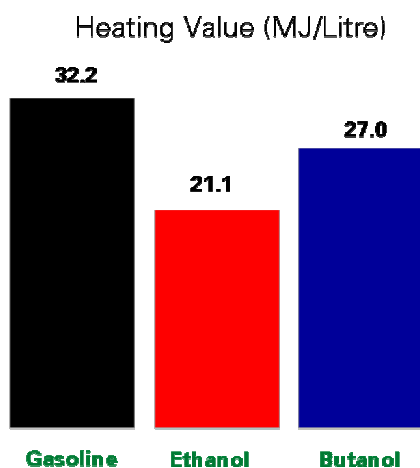


Fig 9: Benefits of butanol

In February 2007, the Energy Biosciences Institute was launched as a 10 year, US\$500 million investment by BP which will focus on conversion of ligno-cellulosic feedstocks. Extensive use of grasses or waste material from sugar is a powerful route to ensuring the maximum benefits from biofuels, based on crops that can grow with minimum irrigation, fertilizer or waste.

- Creating awareness among those who can shape the industry

Engaging with customers. Target neutral is a facility for people, particularly BP customers, to understand their vehicles' GHG emissions and offset them by funding projects which capture carbon. Often these projects have significant explicit socio-economic benefits and they help raise awareness among the wider public of the importance of ecosystems.

Engaging with the industry. BP was the first fuel company to become a member of the Round Table on Sustainable Palm Oil. This enables the needs of the biofuels market to be reflected in the rapidly growing palm oil industry.

Engaging with regulators. BP is actively engaged with government bodies in the UK, Germany and the State of California to ensure practical systems are put in place for verification and certification of sustainability of fuels. Where possible these systems should be harmonized. In particular we are looking to ensure incentives are targeted at those fuels which have optimum GHG balances – and thus are likely to have minimum effect on the Earth's ecosystem.

- Ensuring that we have our own "magnetic north"

BP recognizes that the impact of biofuels on society and ecosystems can be influenced at various stages of the value chain: growing and harvesting; conversion and transport; trading; marketing and consumer choice.

We are developing our own guiding principles. They will be enacted in our business sustainability strategy and reflected in procurement guidelines and operational procedures wherever we operate in the value chain. This is the fundamental tool for determining and constraining our impact on ecosystems.

#### 10. BP's sustainability principles

It is comparatively simple to define the high level principles that BP is planning to put into practice as we develop our business.

Our business will actively aim to:

- Understand the likely environmental and social impact of our planned biofuels operations
- Adopt best industry practices in cultivation and process design
- Look for synergies between biofuels and food production, water management and power generation
- Implement inclusive business models that enable wealth generation among the communities where biofuels are produced

Our business will seek to avoid:

- biofuels that do not provide positive life-cycle greenhouse gas balances compared to the equivalent conventional fossil fuel
- sourcing biofuels from land which, if converted for feedstock production, results in net GHG emissions
- feedstocks sourced from areas of high conservation value
- biofuels produced through processes that place unsustainable stress on the quantity or quality of either soil or water
- biofuels that are sourced from plantations which directly displace food crop production in regions of hunger where markets cannot guarantee availability of staple foods
- production of feedstocks from plantations with improper labour practices or treatment of communities

We are committed to:

- Transparent reporting of our activities
- Auditing and verification of biofuels production
- Engaging with stakeholders
- A culture of continuous improvement

The “bump stops” beyond which the biofuels industry would fail – and so provide none of the intended benefits- are if responsible investors are given no “licence to operate” or if the business cannot provide adequate economic return. There are choices to be made by all stakeholders about how the Earth's ecosystem is adapted to the demands of a growing, energy hungry population. Change of land use for biofuel feedstocks will have a regional impact on some parts of the

planet's ecosystem. The changes, if properly managed, can bring net benefit to the planet's ecosystem. BP wishes to ensure that its operations meet the expectations of society. We recognize that the choices about how biofuels should be produced can best be made in the light of experience gained during biofuel production. We want to "learn by doing".

#### 11. Getting into action: ensuring an acceptable impact on ecosystems

In order to ensure that our impact on ecosystems is acceptable, we have to define a level of specificity to these principles which define "go/no-go" boundaries for our business; meet the reasonable expectations of our stakeholders, who will have diverse priorities and opinions; and which of course are economically viable.

To progress further, we are pleased to take the opportunity to engage in debate here at this conference.

By way of example, some examples of specific principles that BP proposes for its investments are listed below. They are neither definitive nor final at this stage.

BP will make use of environmental and biodiversity assessments to ensure that the effects of the establishment of BP dedicated biofuel feedstock crops on biodiversity are understood and managed appropriately

BP will expect best practice in crop rotation, pesticide and herbicide application so as to foster biodiversity

In food-short regions BP will neither grow nor displace the local recognized staple food for fuel use

BP will actively aim to build sustainable advantage through the implementation of inclusive business models that enable local communities to benefit

We emphasize that the best way to flesh out the aspirations behind these principles is to "learn by doing" as and when we make our investments on the ground. We can then build robust tools to guide our operational staff and robust guidelines for procurement from third parties.

Two other critical components for developing our ways of working are to work with governments and NGOs in formal partnerships on crop specific initiatives and setting standards for the industry. We need to bring the principles to life in a way that is transparent and auditable, yet not burdensome on an industry that requires government help to become established in most parts of the world.

In conclusion, we believe that the biofuels industry will grow rapidly – but need to ensure that guiding environmental and social principles are in place for industry to effectively manage its impact on ecosystems and communities. This will need the pragmatic support of government and non-government stakeholders.