

**International Sugar Organisation**  
**November 2010**  
**Sugar Crop Biofuels – A Vision**

I've been asked to talk this afternoon about a vision for biofuels.

Henry Ford knew a thing or two about vision. He once remarked: "Obstacles are those frightful things you see when you take your eyes off your goal".

When BP addressed this same conference just two years ago – we might well have been forgiven for losing sight of any vision or goal for biofuels in the face of the immense obstacles that the industry then faced.

That same autumn of 2008 - you will remember – there was a global financial crisis – banks were failing. There was an ongoing energy crisis - world oil prices had peaked at \$147 per barrel in the summer. And there was a food crisis - in the preceding 24 months, average world prices for rice rose by 217%, wheat by 136%, and corn by 125%. Although curiously, the sugar price was pretty pedestrian by comparison.

Amidst this Armageddon, the UN's Special Rapporteur for the right to food was driven to assert that biofuels were – and I quote: "A crime against humanity".

My task today is perhaps a little easier. These are calmer waters in which we find ourselves just two years on.

Not that the problems and issues that came together in such sharp focus in 2008 have gone away. But they have subsided somewhat – allowing time for greater reflection and analysis - informed by facts.

## **Visions**

But the problem with being asked here today to talk about 'Vision' is that - just like opinions – everyone seems to have one.

**Scientists** are often a rich source of long range vision – challenging us to think the unthinkable.

For example, the distinguished academic, Nobel Laureate and now US Energy Secretary – Stephen Chu – has articulated a fascinating vision of a global “glucose economy” to supplant mankind’s dependence on oil.

Here, fast-growing crops would be planted where the climatic conditions are right. They would be converted into glucose and the glucose would be shipped around much as oil is today, for eventual conversion into biofuels and bioplastics.

Professor Chris Somerville, at the Energy Biosciences Institute at Berkeley, has also articulated a ‘billion tonne biofuels vision’ – tapping sunlight and biomass – with pathways discovered by what he describes as “massive support for basic curiosity-driven research in many aspects of non-medical microbiology, plant biology, and chemical engineering.”

**Governments** are also expected to be capable of clear thinking and vision – but they may have difficulty currently with the notion of funding anything that might be considered long term or “curiosity –driven”!

Government visions are shorter term and articulated within a political framework of economic, environmental and security drivers – bolstered by multi lateral

commitments – constrained by electoral considerations - and often delivered by the blunt – but often effective - instrument of the regulatory mandate.

The EU has held a biofuels vision that sees one quarter of its road transport fuels met by “clean and Co2 efficient biofuels” by 2030.

For the US - in pursuit of a long term vision of ‘energy independence’ - it means a biofuels share of 20% of road transport fuels by 2022

Elsewhere – in China, Brazil, India – a range of national targets and programmes feature as part of their clean fuels and energy independence visions.

To put those targets into some perspective, the US mandate alone will drive a 50% compound annual growth rate in cellulosic biofuel capacity, involving the development of 220 world-scale cellulosic biofuels plants and, conservatively, around \$100 billion of investment – this in addition to the 170 existing corn ethanol plants. For Brazil – by 2020 – a further 90 world-scale mills will need to be constructed, in addition to the existing 330 mills, to meet the expansion in domestic demand, requiring at least \$40 billion of funding.

Given the scale and importance of the task – and the huge investments required – I cannot overstate the importance of stability and predictability in the regulatory regimes that governments have put in place to support these bold visions. We in the industry are being asked to mobilise resources on a large scale, with long lead times, and, in many cases, significant technology risk. We do not ask for regulatory support in perpetuity, but consistent, stable regulation through the period of

transition to a large scale and competitive Biofuels sector is an essential precondition for progress.

**Corporations** such as BP start from a very different position to the scientists, politicians and NGOs – we are at heart a commercial entity. But that does not mean our own vision is narrow and self serving.

At BP, we firmly believe that what we are seeing today is the coming of age of a new energy sector that over the next 100 years will supplement traditional fossil fuels to create a diverse energy mix, enabling the continued democratisation of access to energy while diluting its environmental impact and underpinning the transition to a more sustainable economy and society.

Why do we say this?

- Because energy demand is projected to grow by anything up to 45% by the year 2030 requiring investment of at least \$1 trillion a year.
- Because the world needs to move on to a more sustainable course by using energy more efficiently through energy *saving*; AND by switching a proportion of the energy that it does use to low-carbon forms of fuel and power through energy *switching*.
- And because large consuming countries - from the US and China to Germany and the UK - want to source more of their fuel and power locally to reduce import dependence.

In order to make this major shift, the world needs to diversify its energy mix to incorporate more low carbon energy and more local energy.

In the transport sector, energy saving will come about in many ways, including more efficient engines, lighter cars, hybrids and plug-in hybrids. But the possibilities for energy switching are limited.

So in terms of new *fuels*, biofuels are the primary means of bringing secure, sustainable, low-carbon fuel to vehicles in the next two decades. Some have suggested that they could account for up to 20% of the road transport fuels market by 2030 – depending on a range of factors.

To put that in some context an industry of this scale would provide a new, globally diversified, oil production source - based primarily on sugars - that will become the world's 3<sup>rd</sup> largest source of liquid hydrocarbons - after Saudi Arabia and Russia. All within the next 20 years.

This isn't just about scale of course – it's also about ambitious growth. Delivering this scale would mean that the projected annual growth in volumes from the global biofuels industry between 2010 and 2030 will outstrip the best that any individual OPEC or non-Opec oil producer has been able to achieve in growth terms over the past 5 years.

So this vision represents the beginnings of a major structural change in the world energy industry at a time when traditional sources of energy are under immense pressure to meet demand and other political, economic and environmental objectives.

So, the opportunity for sugar producers and biofuel producers is clear.

And for a company like BP it is a natural extension to our traditional energy business.

Because at its core, what we do with petroleum – sourcing and converting that really old biomass into gasoline - is similar to what we plan to do with biofuels — sourcing and converting a much younger biomass into liquid transportation fuel.

We think of biofuels as a “renewable well.”

### **Advantaged Biofuel Pathways**

How do we see this new world evolving to 2030?

People frequently talk in terms of first and second (or even third) generation biofuels.

This terminology is convenient when conveying the role advanced technologies and practices have in helping to increase the availability, sustainability and performance characteristics of biofuels.

But it doesn't mean later generations are necessarily better than their predecessors.

For example, Brazilian sugar cane ethanol today is an advantaged biofuel. It is at least as good in terms of efficiency and sustainability as many so-called advanced biofuels that are in development and will compete in the long term.

That's why we talk in terms of a continuum rather than discrete generations.

We believe that a biofuel should be judged on the contribution it can make and the impact it can have – and in developing and continuously improving those biofuels with the best sustainability and performance characteristics.

These biofuels do not all sit in the same generation. Biofuels done well today, play a critical role in getting to better biofuels tomorrow.

They create a market (with appropriate infrastructure and vehicle compatibility) that will attract technology investment; and they provide ready platforms for the prototyping and early commercialisation of advanced technologies within the next five years. For example, ligno cellulosic or premium molecules like biobutanol.

### **Success Criteria**

For us advantaged biofuels are those meeting 4 criteria - whether that means the latest promising innovation to emerge from the lab or sugarcane ethanol as it has been produced in Brazil for decades.

They need to be **low-cost** – our benchmark for success is \$1 a gallon, so that the biofuels can compete with oil when it is about \$40-50 a barrel.

They must be **low-carbon** – genuinely low-carbon from well-to-wheels, or from plough-to-piston basis once all measurable emissions, absorption and mitigation factors are accounted for.

Advanced biofuels also need to be **scalable**. There is no point making boutique biofuels. Only mass production and mass distribution can turn the dial.

Fourth, advanced biofuels have to be **sustainable** – environmentally, socially and economically.

Those criteria have so far led us to three main strands of large-scale investment:

- producing biofuels from sugar cane in Brazil;
- preparing to produce cellulosic biofuels from dedicated energy grasses in the US;
- and developing advanced molecules - biobutanol and diesel from sugars - that can be deployed in existing and new ethanol production units.

As I have said, sugar is central. So let me say a little about each of those three elements which implement our strategy.

### **Brazilian Sugarcane Ethanol**

I am sure you are all familiar with the fact that sugarcane is the best option for biofuels today. Brazilian sugarcane ethanol has high yields per hectare and can reduce GHG emissions by up to 90% compared with gasoline.

We have been working with partners in Brazil – producing ethanol – since 2008 and we see long-term growth opportunities.

And Tropical Bioenergia, our joint venture in the country has been performing exceptionally well. One thing I'm particularly proud of is the safety record that it is developing – setting a benchmark for the Brazilian ethanol industry.

In 2009, the average Recordable Injury Frequency – that is the number of work-related incidents causing an injury per 200,000 hours worked - was 8. Tropical's



recordable injury frequency was just 25% of that figure, and this year it is expected to be lower yet.

We have implemented a number of safety programmes along with our partners and seeing this make real differences to people's day-to-day experience of working at the facility is humbling.

It is this sort of biofuels business development which will build a solid foundation for the credibility of the whole industry.

### **Ligno-Cellulosic Ethanol**

Looking further ahead, we have for some time been exploring the best way to play a part in the developing efforts to commercialise ligno-cellulosic feedstocks and technology – LC for short. This technology enables us to access the more difficult to reach sugars locked up in the structure of the plant.

In 2008, we created a strategic partnership with Verenium Corporation in the US, to accelerate the development of LC ethanol.

This partnership linked our capabilities in production, distribution and logistics with Verenium's technology platform – a platform that we believe to be the most advanced technology in the world for transforming the sugars in energy grasses to biofuels.

In July this year we acquired the biofuels business of Verenium.

Our 1.4 million gallon demonstration facility in Louisiana is making cellulosic ethanol from a range of feedstock and generating a wealth of design data - we have

achieved a number of operating and technology breakthroughs which give us confidence in how to take the technology up to commercial scale – in fact we have started the development of our first commercial facility is under way in Florida.

Furthermore, leading scientists and technologists are generating biofuels innovations in our purpose-built bioscience R&D facility in San Diego, California.

### **Biobutanol**

A third area of focus for us is biobutanol - a molecule with great potential over the medium term. We are acting to accelerate its development.

Butanol is an advanced molecule with a higher energy density than ethanol. It can be blended into fuels in higher concentrations than ethanol.

We have been partnering with DuPont over a number of years to develop this molecule and we now have a technology demonstration plant, currently commissioning, in Hull. This is being operated by Butamax Advanced Biofuels, our joint venture with DuPont which is now responsible for bringing biobutanol to market.

This plant has been constructed alongside a larger bioethanol plant which we are building in collaboration with a partner familiar in this industry – Associated British Foods called Vivergo Fuels

The construction project of Vivergo Fuels - currently the second largest in the UK after the London Olympics project - is well underway and due on stream next year. In addition to making 350 ktes of high protein animal feed (and replacing imports of

soy meal) it will produce 420 million litres when on-stream – making it one of the largest ethanol facilities in the world.

Ultimately, we plan to use the expertise we gain from the demonstration plant to convert the Vivergo plant to biobutanol.

### **Sugar to Diesel**

Sustainable biodiesel has been a problematic challenge for the industry. We are finding improved ways of producing renewable diesel from sugars. Our partner is Martek Biosciences – a leader in producing high value oils from algae and other microbial sources.

The sugars can come from many sources including sugar cane and the LC feedstocks that we are currently working with.

So that gives you a brief picture of our activities.

We occupy a unique position within the emergent Biofuels industry as an integrated operator with end-to-end capability, from R&D, scale up, commercialization, blending and distribution.

We are in action demonstrating our vision that sustainable high energy, low carbon, commercially viable biofuels from sugar at scale can be a reality.

### **Partnerships**

We recognise that the creation of an advanced biofuels industry will require unique combinations in capabilities and skills.

It will require players such as BP who are used to mobilising capital of billions of dollars in developing complex, resource to market projects which have long term investment return horizons.

It will also require players familiar with industrial scale farming and skilled in the husbanding of the vast tracts of marginal land required to bring on our new energy crops. Each world scale US plant will need around 50,000 acres, each Brazilian plant 50,000 hectares.

And it will require players working at the forefront of the *technologies* required to underpin the new products produced.

This is why *partnerships* are at the core of our business model.

A second structural challenge is how we best align the targets of government mandates with the practical realities of bridging from a world today where we have to blend ethanol and fame into conventional fuels to a time when the infrastructure – whether vehicles or distribution - has adapted to Biofuels.

It's one thing to mandate – another to deliver!

## **Blend Wall**

The so called 'Blend Wall' – the maximum percentage volume of ethanol and conventional bio-diesel blended with gasoline or diesel that the existing vehicle fleet can cope with – is a significant hurdle to the increased penetration of Biofuels vision.

Ensuring support to accelerate the deployment of drop in biofuels such as biobutanol than can be used at a higher percentages in existing vehicles is an example of the kind of measure that will go a long way to eliminating the blend wall barrier and meeting biofuel mandates at low cost to the consumer and taxpayer.

### **Vision and sustainability**

But of all the challenges facing any vision for biofuels, none - I would assert - is greater or more important than how the new industry measures up in terms of sustainability.

There is no doubt that some of the early controversies over biofuels are being allayed.

The World Bank and the UK's Department for the Environment, Food and Rural Affairs, have all concluded that biofuels have not been the main contributor to fluctuating/escalating food prices.

And Defra's report suggests that the food crisis in 2008 allowed critics of ethanol to make an easy scapegoat of the industry during a period of unprecedented expansion – and that oil prices played a significant role in driving agricultural costs up.

Going forward, the Report was very optimistic about the world's ability to respond to both demand for biofuels and the need for additional cropland.

And of course, if Biofuels are NOT a key driver of food prices, it becomes very difficult to sustain an argument that Biofuels are, as a whole, drivers of indirect land use change.

But let's also be candid that challenges remain. Sustainability is quite simply our licence to operate

If you can't make biofuels that genuinely lower emissions without unacceptable tradeoffs to the food chain or habitats then it would be better not to make them at all.

### **Small and Large Scale Biofuels**

Which brings me to a very different vision for biofuels articulated by NGOs such as Christian Aid.

It believes that biofuels require a 'social' vision, one that does not focus on supplying significant quantities of transport fuels for industrialised markets.

It believes the right approach is to grow on a small scale and process them locally "to provide energy for surrounding communities, increase rural incomes, and improve soil fertility without compromising food security"

At BP, we don't believe that industrial scale biofuels are appropriate in 'early' developing world countries for many years yet.

We believe the business risks are too great to make it a competitive, commercial choice for those countries and participants compared to more developed or developing nations.

We believe a two-track approach is appropriate. Small-scale, local biofuels industries can play an important role in these 'early' developing countries as a cash crop, inter-cropped with other subsistence crops.

This creates small local markets; it increases the resilience of local economies and populations; and it increases the resilience of that country to the irregular supply and price of energy which in turn increases its resilience to energy's impact on food prices because a lot of what drives food price is the price of oil.

Large-scale, international biofuel industries also add resilience and are complementary to the development and benefits of local biofuels activities in developing countries.

Biofuels at scale act to dampen international energy prices; they lower a key input cost to food; and deliver major greenhouse gas reductions.

Over the longer term, industrial-scale biofuels are not in competition with food crops. If the industry is to compete with \$50 oil it can only grow sustainably at scale by utilising the lowest cost useable land – not the premium cost, prime arable land such as the cornfields of the US mid-west.

So our vision can chime with that of the NGOs. Both approaches are complementary in increasing the resilience of the world to feed itself and to most productively use its resources as population and aspirations grow. The alternative is to ration resources.

This is easy to say I know. And we have seen how prey to criticism and misunderstanding this new industry can be.

The public need demonstrable evidence that our vision has sustainability at its core.

That means we need to work together as an industry to develop the standards, metrics, guidelines and principles that provide the evidence the public demands.

That is why the work of the Better Sugarcane Initiative is important.

It has completed its formative stage and is now about to graduate as a fully fledged scheme – one that can earn respect and trust for the sugar and energy products that are the cornerstone of the new biofuels industry.

If applied universally, BSI will reduce the environmental and social impact of sugar cane cultivation and downstream production.

The draft standard has already received a welcome from the EU.

The approved version will allow companies to import sugar cane ethanol into the 27 nations of the EU under a single certification process that is fully compliant with the EU's sustainability criteria.

So I hope in my remarks this afternoon, I have been able to convey a sense of vision for an emerging sugar biofuels industry– as well as to explain some of the things we at BP are doing to bring that vision to reality.

Advanced biofuels are now coming of age. Supportive regulations are being firmed up and embedded.

New technologies are coming to fruition. And many of the controversies over issues such as food and fuel are being resolved.



The Chinese have a saying: "Vision without action is a daydream. Action without vision is a nightmare".

Perhaps history will record the very early years of biofuels development as too much 'action without vision'.

I think we are now much better placed to combine vision and action and grow this absolutely vital new industry in a vibrant and sustainable way.

Thank you.