biofuels international

September 2007
Issue 4 • Volume 1

Driving the market forward

– what effect do biofuels have on engine performance, and how much do emission levels actually vary?

Regional focus: Biofuels in southern Europe

We are designing, installing and starting up over 7.000.000 Tons/Year biodiesel plants

Over 50 plants

Argentina • Brazil • Bulgaria • Colombia • Czech Rep. • Estonia • France • Greece • Italy • India
Indonesia • Malaysia • Netherlands • Peru • Poland • Portugal • Romania • South Korea • Spain
Singapore • Slovakia • UK • USA

Capacity range

Desmet Ballestra is designing and supplying multiple feed stock biodiesel production plants, sized in a wide range of capacities from 50,000 up to 500,000 T/Y, complying with the most stringent international standard specifications.

Multiple feedstock

- animal fats
- palm oil
- cottonseed
- rapeseed
- soybean
- jatropha
- sunflower
- UFO/UCO

desmet ballestra
Advanced biodiesel technologies with strong local support, close to you

Call our offices or write to
info@desmetballestraoleo.com
to get the best biodiesel solution today!

oleochemicals & biodiesel

desmet ballestra

Science behind Technology

www.desmetballestra.com

biofuels international
issue 4 volume 1
September 2007

Horseshoe Media Limited
Marshall House
124 Middleton Road,
Morden,
Surrey SM4 6RW, UK
www.biofuels-news.com

EDITOR
Margaret Garn
Tel: +44 (0)20 8687 4126
margaret@biofuels-news.com

DEPUTY EDITOR
Luke Buxton
Tel: +44 (0)20 8687 4146
luke@biofuels-news.com

ADVERTISING SALES MANAGER
Joseph Quinn
Tel: +44 (0)20 8687 4139
joseph@horseshoemedia.com

ADVERTISING SALES EXECUTIVE
Pierre-Gomis Diallo
Tel: +44 (0)20 8648 7092
pierre@biofuels-news.com

ASIA PACIFIC CONTACT
Anthony Chan
Tel: +65-6345-7368
Fax: +65-6344-4909
Mobile: +65-9638-2282
acesap@singnet.com.sg

PRODUCTION
Alison Balmer
Tel: +44 (0)1673 876143
alisonbalmer@btconnect.com

SUBSCRIPTION RATES
£145/€227/$277 for six issues per year.
Contact: Lisa Lee
Tel: +44 (0)20 8687 4160
Fax: +44 (0)20 8687 4130
marketing@horseshoemedia.com

ISSN 1754-2170

contents

Make biofuels better with Grace

Grace Davison Biofuel Technologies Group

It's a natural progression.

Grace, a leading provider of specialty catalysts, adsorbents and analytical tools to petroleum refiners, is now applying its peerless materials science expertise to improving the manufacture of renewable fuels.

With Grace innovations customized for your process, biorefining becomes simpler, faster, and more efficient.

Our technologies ensure that fuels that are environmentally friendly are manufactured in processes that are economically sound.

Make biofuels with Grace, fueling innovation for sustainable energy worldwide.

www.GraceBiofuels.com

Contact davison.info-biodiesel@grace.com

Regional Headquarters Europe:
Grace GmbH & Co. KG, In der Hollerhecke 1, 67545 Worms, Tel: +49 6241 403 0

GRACE

Feel the power

Margaret Garn
Editor

Championships such as the IndyCar series have raised the profile of biofuels over the past few months, especially with the decision to run the super-fast vehicles on 100% ethanol.

In doing this, organisers are showing drivers that not only can ethanol have a positive effect on the environment, but it can also enhance engine performance.

The reliability of ethanol in the series has been without question, and the fuel efficiency has also been impressive – through 2007 the IndyCar series consumed around 30% less fuel than last.

High profile races such as these are having a positive impact on the vehicle industry as a whole. Automotive manufacturers around the world are constantly bringing out new environmentally friendly vehicles, and consumers are slowly beginning to respond.

Inevitably challenges still exist, both when trying to incorporate a new fuel into existing infrastructure and also surrounding the engines themselves and the various modifications required to run new, alternative fuels.

Due to its octane content, running high ethanol blends in a specially designed car can give outstanding results. But put it into a car that is not expecting it, and it is a different matter altogether.

This is something drivers in Michigan, US, found recently when an underground storage tank at a Shell petrol station appeared to have been mistakenly filled with ethanol, rather than unleaded petrol.

Because many vehicles were not equipped to run on the fuel it wreaked havoc, triggering warning lights, causing cars to stall and affecting emission levels.

This mishap highlights some of the drawbacks that can occur when trying to encourage high biofuel blends. But this is not to say that it is necessarily a bad thing.

High levels of ethanol run perfectly well in specifically designed flex fuel vehicles, but in standard vehicles many systems struggle to cope. However, the industry is slowly adapting and the divergence between flex fuel and non-flex fuel vehicles is gradually getting smaller.

When it comes to introducing high levels of biodiesel to the market, there are different challenges altogether that need to be addressed, many of which are discussed later in this issue.

We hope you find this useful, both for business and perhaps even when you come to buy your next car. As always if you do have any comments on anything covered in the magazine do get in touch,

Best wishes,
Margaret

A bioethanol-powered car leads a British GT race

Jamaica selects castor beans as biodiesel feedstock

A Jamaican study to use castor beans for biodiesel has been supported by Brazil's biofuel experts. Castor oil is the most important feedstock from perennial crops for biodiesel made in Brazil, where it is grown in the arid northeast by small farmers under the Social Fuel policy.

Gary Andrews@bigstockphoto.com

A castor oil plant

Phillip Paulwell, Minister of Industry, Technology, Energy and Commerce, says Jamaica is now building concrete plans around the crop, to cut oil dependence. Jamaica imports 90% of all its oil products, and high prices are affecting the island's trade balance.

Castor beans have a high oil content and are widely grown by smallholders on the island. The poisonous plant provides a safe opportunity for biodiesel development without the risk of displacing food crops, and it grows in poor soils.

Jamaica's Coimex Group operates an ethanol plant together with Petrojam. Karl James, the chairman of Petrojam Ethanol, declares: 'There are plans for a major commercial plant to be constructed and many people are now preparing their land for castor beans.'

He adds: 'We believe that large areas of rural Jamaica could be quickly transformed into attractive economic zones where independent small land owners can be engaged in the production of an agricultural product for which there is a ready market at a price that should provide a satisfactory return.'

As a perennial crop, castor bean can be produced on varied levels from large scale farms to cottage industries, involving thousands of small farmers in rural areas.

Jamaica currently uses 168 million gallons of diesel fuel and will need 5 million gallons of castor oil for an initial B2 biodiesel project. According to the Minister, the reduction of just 2% of diesel imports will help the country's balance of payments and increase agricultural output.

India proposes biodiesel policy

The Indian government has declared a biodiesel purchase policy to replace fossil fuels through non-conventional means of energy.

The declaration follows an announcement in May to establish enterprise-driven biodiesel production in India.

'The salient features of the biodiesel purchase policy are that the public sector oil marketing companies will buy biodiesel, meeting the Bureau of Indian Standard Specifications through their select purchase centres,' Murli Deora, the Minister for Petroleum and Natural gas, says.

The policy was introduced as ministers felt the issue of energy security was important in relation to the rapidly expanding Indian economy. A review on energy sources would help sustain the growth in a more environmentally-friendly way, particularly with a focus on using biodiesel.

India's biofuels industry is still in its early stages. Salil Singhal, deputy chairman of the Confederation of Indian Industry (CII) northern region, remarks: 'The development of bioenergy is important for rural, economical and agricultural growth. Bioenergy is critical to India's energy mix.'

Over 30% of India's primary energy comes from non-commercial sources that include agricultural and forest waste, wood chips, animal waste and biofuels made from non-edible oils. The share of such non-commercial energy is second only to coal, which accounts for around a third of India's primary energy mix. Bioenergy meets approximately 60% of the domestic energy needs of India, Singhal adds.

Under the new movements, biodiesel manufacturers interested in supplying biodiesel will register with state-level coordinators. Producers proposing to manufacture biodiesel from non-edible oils will be given priority.

Oil marketing companies will decide a uniform delivered price for buying biodiesel, to be frozen for six months with a review following. The ministry has identified 20 biodiesel procurement centres in nine states.

The government is facing problems in establishing an ethanol blended petrol programme. The execution of excise permits and legal notifications by state governments have caused delays.

World's largest soybean-based biodiesel plant opens

The largest soybean processing and biodiesel plant has opened in Indiana.

The Louis Dreyfus facility is expected to begin biodiesel fuel production – using the autumn soybean harvest – by early next year. The plant's capacity will be approximately 250,000 gallons of biodiesel a day (80 million gallons annually), and will produce in excess of a million tonnes of soybean meal each year.

The plant will process soybeans from both county and regional farmers. About 50 million bushels of soybeans, almost a fifth of all soybeans grown in Indiana, will be crushed.

The total capital investment of the facility is $150 million (€109 million) .

The company is developing additional biofuel assets in the US, including an ethanol plant in Nebraska. Louis Dreyfus Commodities' presence in the expanding biofuels sector includes a leading position in the Brazilian ethanol market.

Doreen Loftin@bigstockphoto.com

First US state to impose B20 biodiesel rule

Minnesota's Governor has proposed plans to raise the biodiesel mandate from 2% to 10% in every gallon of diesel fuel sold by 2015.

A B5 blend could take effect next year if approved by legislators.

'Increasing the level of biodiesel in diesel fuel means that more of our energy will come from farm fields rather than oil fields and that's a good thing,' Minnesota Governor Tim Pawlenty says.

Four other states in the US have biodiesel standards, none above a B5 blend requirement. Critics argue that mandating boutique fuels is a backdoor attempt of boosting the farming industry. The cost of food could rise as corn and other agriculture supply is diverted away from the food market and into the fuel market.

Elecnor plans Spain's biggest biodiesel plant

Spanish power company Elecnor will build Spain's biggest biodiesel production plant, costing €70 million.

The plant, on a 31,000 square metre site in the port of Gijon in northern Spain, will be ready in 22 months and will produce up to 500,000 tonnes of type EN 14214 biodiesel a year from vegetable oil.

It will be built at the Muelle de la Osa wharf. The developer on the project is Nátura Energía Renovable, a subsidiary of the Jiménez Belinchón Group.

This project serves to consolidate Elecnor's growing involvement in the field of biofuels, and in the renewable energy sector in general, with a particular focus on photovoltaic solar energy, through its subsidiary Atersa.

Researchers pour whisky in the fuel tank

inaquim@bigstockphoto.com

Researchers at Abertay University, in Scotland, UK, have been awarded a grant to investigate the potential of converting whisky and beer residues into biofuel.

The researchers will look into new methods of turning spent grain into bioethanol, which is carbon neutral, and produces 65% fewer greenhouse gas emissions.

'Our research will be looking at the far more complicated process of turning waste products from industry into bioethanol as an example of a second generation biofuel,' Graeme Walker, leader of the year-long project, says.

'These products are currently disposed of or processed for animal feed and turning them into fuel would be an attractive use of the resource. At the moment many technical challenges remain to converting waste biomass into fuel. We will focus on finding more efficient and cost-effective processes.'

Verbio considers investment in Bulgaria

German-based biofuels producer Verbio Vereinigte BioEnergie is considering plans to invest up to €100 million in a biofuel production facility in Bulgaria.

The announcement follows the meeting between Verbio CEO Claus Sauter and Bulgarian Energy Minister Petar Dimitrov.

The company would situate the new facility close to a port. Bulgaria's city of Varna on the Black Sea is one being reviewed.

Verbio would produce both biodiesel and bioethanol if the plan is finalised, making Bulgaria a major source of biofuels in southeastern Europe.

The company has a number of biofuels facilities in Germany, with a total annual production capacity of 700,000 tonnes.

Verbio uses rapeseed and rapeseed oil as raw materials, and aims to introduce palm oil to its production line before 2008.

Ethanol across the Irish petrol station network

The Maxol Group, an independent oil company based in Dublin, Ireland, has announced it will replace its regular unleaded petrol with E5 fuel (95% petrol and 5% locally produced bioethanol) at 150 Maxol service stations across Ireland in September 2007.

The E5 fuel price will match that of standard unleaded petrol.

Maxol's E5 fuel has been successfully piloted at over 24 service stations throughout northeast Ireland since September 2006.

The bioethanol fuel in E5 is made from whey, a milk derivative and a by-product of the Carbery Milk Products Cheese plant in Ballineen, County Cork.

Tom Noonan, CEO of Maxol, says: 'This move towards ethanol use helps Ireland to meet EU targets. It is a win for consumers who benefit from lower emission fuel at no extra cost, a win for agriculture, which can now develop interests in ethanol production, and a win for the economy in that it could potentially reduce our imports.'

Maxol launched its E85 fuel (85% bioethanol) onto the Irish fuels market in September 2005.

BP's ethanol in the outback

BP Australia and Manildra Energy Australia, an ethanol producer, have announced a biofuels supply agreement ensuring almost half of BP's fuel sales in the state of New South Wales will contain renewable ethanol.

BP will receive 40 million litres of ethanol from Manildra's Bomaderry ethanol plant over the next year. Negotiations to extend the agreement for a further two years have begun.

The agreement with Manildra, combined with its existing 15 million litre ethanol supply deal with Australia-based ethanol producer CSR, makes it the largest marketer of biofuels in Australia, BP says.

BP is investing approximately A$4 million (€2.4 million) to enable the delivery, storage and blending of ethanol at its Newcastle and Parramatta terminals. The ethanol will be blended to produce unleaded petrol with up to 10% renewable ethanol, made from the by-products of sugarcane or grain.

Since 2001, BP has been marketing ethanol-blended fuel in Queensland, and will now sell the fuel to about 50 additional locations by the end of 2007. In the near future BP estimates that 100 service stations will sell the blend.

BP Australia's president Gerry Hueston says: 'Increasing the supply of biofuels is part of BP's long-term strategy to provide Australian motorists with a range of cleaner fuels.'

Trading Emissions invests in Brazilian biodiesel plant

Trading Emissions, a closed-end investment company based in the UK, has invested $66.1 million (€48 million) in an equity stake to fund the construction of a biodiesel refining plant in Brazil.

The plant, in the state of Goias, will produce 200,000 tonnes of biodiesel annually, and has secured the rights to commercialise all credits it receives – certified emissions reductions (CERs) – for cutting carbon emissions from the project.

The plant is expected to be commissioned in July 2008. Additionally, the project will invest in the cultivation of non-edible feedstock, including jatropha, to provide a secure and cost-effective supply to Bionasa Combustivel Natural, a specially formed company.

Paulo Todaro of Mercatto Investimentos, the investment advisor to Bionasa, says: 'This deal represents one of the largest biodiesel projects in Brazil as well as one of the largest equity plays in this space.'

Ricardo Nogueira of EEA Fund Management, the investment advisor to TEP, adds: 'This is a great opportunity for Trading Emissions to partner with one of Brazil's leading agricultural players and to benefit from the Brazilian government's new legislation that sets mandatory targets for the proportion of biodiesel to be blended in to Brazil's biodiesel.'

Colombian government invests in five biofuel projects

Colombia's agriculture ministry will invest 20 billion pesos (€7.3 million) in five biodiesel and ethanol projects before 2012.

Feedstocks for biofuels use include palm, sugarcane and yucca, an evergreen plant, grown on approximately 40Mha of land, available without threatening food supply.

Colombia produces 1.1Ml/d of ethanol, making it the second-largest producer of the biofuel in Latin America, behind Brazil. The country produces 170,000 l/d of biodiesel using African palm, and targets an increase in capacity to 800,000 l/d by 2008.

A yucca plant

Rachel L. Sellers@bigstockphoto.com

Tanzania biofuel farm set for a sunny investment

Sun Biofuels, a UK-based biodiesel producer, has invested $20 million in a biofuel processing project in Tanzania.

9000 hectares of Tanzanian land will be acquired by Sun Biofuels

The project, Sun Biofuels Tanzania, involves large-scale planting of jatropha oilseed crops for the production and distribution of crude and refined products. The company has applied for 9,000 hectares of land in the Kisarawe district in the coast region.

Sun Biofuels had applied for 20,000 hectares in 2005, but authorities were able to offer just 9,000.

The process of land acquisition for the project is at an advanced stage, awaiting President Jakaya Kikwete's agreement. The acquisition means that 11 villages in one of the oldest districts in Tanzania must relinquish a total of 9,000 hectares of land to the investor.

Apart from Sun Biofuels' 88% stake in the project, share holders in Sun Biofuels Tanzania include the British national Julian Ozanne (10%) and Daudi Makobore and Herbert Marwa, Tanzanian nationals, who own 1% each.

The annual yield per hectare is up to 8 tonnes of jatropha seed, which contain over 30% oil. At $320 per tonne, this will translate into production of jatropha crude oil worth $768 a hectare a year.

Tax cuts German biofuel success

Germany's biodiesel production capacity was set to rise to a record 5 million tonnes in 2007, but has been undermined after the industry failed to block the government from reversing a tax relief scheme in July.

Year	tax rates biodiesel	tax rates vegetable oil
2007	9 Cents/litre	0 Cents/litre
2008	15 Cents/litre	10 Cents/litre
2009	21 Cents/litre	18 Cents/litre
2010	27 Cents/litre	26 Cents/litre
2011	33 Cents/litre	33 Cents/litre
from 2012	45 Cents/litre	45 Cents/litre

In 2004, the German government exempted biofuels from taxes and introduced subsidies that accelerated expansion of the biodiesel industry. Combined with high oil prices, biodiesel sales in Germany rose to 2.8 million tonnes in 2006, accounting for almost 5% of the country's total transport fuel sales.

Biodiesel industry sources in Germany estimate that only about half the 5 million tonne capacity will be used in 2007 following a dip in demand after taxes on biofuels were introduced. The government implemented the tax in response to a ruling by the European Commission that Germany's tax relief scheme overcompensated biofuel producers.

'The biodiesel industry has peaked; capacity has grown very quickly and outstripped production and now some companies might even go bankrupt as the industry consolidates,' Norbert Allnoch, director of the International Economic Platform for Renewable Energies, an independent research body located in Münster, says.

On January 1 2007, the government introduced legislation for all fuel companies to add 5% biodiesel to all conventional diesel sold. Estimations show that the interest in biofuels saved Germany from emitting almost 13 million tonnes of carbon dioxide in 2006.

Another 1.3 million tonnes of pure biodiesel was sold in 2006. Sales have been affected by the new tax of €0.09 a litre, which was introduced in August last year.

Karin Retzlaff from the Association of German Biofuel Industry remarks: 'Pure biodiesel is not competitive when taxes are put on it, especially if the oil price falls'.

The problem is more acute for transport companies, which are the main customers for biofuels. They are looking to reduce the fuel bills of their huge fleets of lorries by tanking with the cheapest fuel.

Taxes on pure biodiesel are set to increase further by €0.06 every year commencing 1 January, 2008, to reach €0.45 a litre by 2012.

'Biodiesel producers will need to find new export markets to make up for the drop in demand in Germany, but there are opportunities, for example, in eastern and southern Europe,' Allnoch says.

Adding to the new taxes, biodiesel producers could also be affected by a rise in the price of rapeseed. Rapeseed oil is the raw material that is used to produce more than 70% of biodiesel in Germany. Imported soybean and palm oil made up another 20% of the raw material.

In 2006, rapeseed was grown on about 1.5 million hectares of land in Germany, or 11% of the total agricultural land area; approximately 7 million hectares was used to grow crops for food.

In 2006, Germany used 28.2 million tonnes of diesel for transport fuel, 21.8 million tonnes of petrol, 2.5 million tonnes of biodiesel, 1 million tonnes of plant oil and 480,000 tonnes of bioethanol.

Japan takes a chip out of the biodiesel market

A Japanese government-affiliated research institute has developed technology for creating a diesel fuel from materials such as grass cuttings and wood chips.

Similar technology exists for bioethanol fuel for petrol cars, but the research would be a world first for diesel vehicles.

The Research Institute of Innovative Technology for the Earth (RITE) is aiming for commercial production by 2010. RITE was established in 1990 by the government and leading Japanese firms in such industries as automobiles and power.

The biodiesel fuel uses butanol made using genetically modified microorganisms. The biobutanol is created by cultivating a number of microbes and adding sugar produced by breaking down such plant fibres as grass and tree cuttings, wood and rice straw.

Biodiesel fuels have been made from materials like coconut and tempura oils. There has been competition among RITE, BP of the UK, US company DuPont and others to create a biodiesel fuel from plants. RITE has already applied for an international patent on the technology.

Woodchips and grass cuttings are being tested

Department of Energy supports cellulosic biofuels projects

The US Department of Energy (DOE) has made a funding opportunity announcement (FOA) to support the development of commercially viable enzymes and encourage cellulosic ethanol production.

The FOA will allow funding up to $33.8 million (€2.8 million).

Non-food materials and agricultural waste such as corn stover, switchgrass, and prairie grass could be used.

As part of the country's Twenty in Ten Plan, which aims to convert 20% of the nation's petrol usage to biofuels by 2017, the DOE is seeking a long-term strategy to support increased availability and cost-effective use of renewable and alternative fuels.

'These enzyme projects will serve as catalysts to the commercial-scale viability of cellulosic ethanol, a clean source of energy to help meet the goal of reducing our reliance on oil,' DOE's assistant secretary Andy Karsner says.

By harnessing the power of enzymes, biorefineries can more efficiently use cellulosic feedstocks for biofuels production. The latest funding aims to further reduce costs of enzyme system preparations in process-relevant conditions.

The FOA concentrates on systems to hydrolyse and saccharify cellulosic biomass feedstocks. Saccharification enables the biorefining process by breaking down pre-treated cellulosic material into simple sugars, enabling them to be processed further through fermentation and subsequently into biofuels such as ethanol. ●

Jatropha-based biodiesel project in Mozambique gets funding

Energem Resources, a Canadian company focusing on natural resources in Africa, has acquired a 70% controlling interest in a biodiesel venture in Mozambique that will be using jatropha.

Energem has committed up to $5.5 million (€4 million) to fund further development of the project.

During 2008 plans include planting an initial 1000 hectares, and a further 5000 hectares of land, targeting up to 60,000 hectares (presently under application from the Mozambiquan Government), and producing the first crop of unrefined jatropha seed oil.

The venture has also established jatropha seedling nursery facilities. Three years of R&D have aided the project looking into the use of jatropha in Mozambique as a crop to produce oil for transesterification and further refining to biodiesel.

The company has established a new operating division, Energem Biofuels, with the Kisumu ethanol plant in Kenya at the centre of its redefined strategic focus, primarily on the mid-stream oil and gas infrastructure and biofuels sectors. ●

NZ introduces first commercial ethanol-based fuel

New Zealand has launched its first commercially available biofuel. The fuel is a 90% petrol and 10% bioethanol blend made from cow's milk.

New Zealand Prime Minister Helen Clark believes the fuel will help New Zealand become a greener nation. 'The transport sector accounts for 40% of our carbon dioxide emissions,' she states.

The government has imposed legislation that means that oil companies' sales will have to consist of at least 0.2% of biofuels by next year and 3.4% by 2012.

code2707@bigstockphoto.com

Gull, a small chain of 30 petrol stations located on New Zealand's North Island, will sell the fuel. ●

IBI announces Argentinian biodiesel expansion

Integrated Biodiesel Industries (IBI), a Brazilian biodiesel production company, will acquire a minority equity stake in Argentinean biodiesel producer Diferal, and market the total output of its plant.

'The deal with Diferal is strategic to IBI,' says Marcelo Lopes, IBI's CEO. 'It will allow a quick expansion into major soybean producer Argentina and access to a captive supply of competitively priced biodiesel sources.'

Diferal has built a plant with an annual capacity of 32 million litres (8.5 million gallons) in the city of Rosario, poised to begin operations in early September.

Argentina is the world's third largest soybean producer and Rosario's port is the country's main grain exporter, located at the Rio Parana river, which provides direct access to both the Atlantic and Pacific oceans.

The Rosario plant's total output is currently 2,100 tonnes a month, with plans to increase this to 3,100 tonnes in the near future with a small additional investment.

The company has a tolling agreement with Louis Dreyfus, an international commodity company, to extract soy oil from grain acquired by Diferal. Dreyfus will also acquire all soy meal produced in the process.

Diferal has successfully field-tested a mixture of aviation fuel and biodiesel, called Biojet, which is currently undergoing further studies. ●

SWISS COMBI
W. Kunz dryTec AG
CH - 5606 Dintikon
Phone +41 56 616 60 30
Fax +41 56 616 60 31
info@swisscombi.ch
www.swisscombi.ch

ecoDry

THE solution for DDGS drying

- Closed steam loop
- Integrated thermal oxidation
- Integrated product cooling
- High potential for energy recovery
- Low energy consumption
- High product quality due to superheated steam drying
- Compact layout
- Proven technology

SWISS COMBI

Algae biodiesel plant planned in Portugal

Vertigro, owned by US ecotechnologies developer Valcent Products, has agreed to form a joint venture to produce biodiesel from algae, together with SGCEnergia, the biofuels division of the SGC Group of Portugal.

bobelias@bigstockphoto.com

Algae will be grown near major sources of carbon dioxide emissions

SGCEnergia will build and operate a Vertigro pilot plant near Lisbon, Portugal, which will also serve as an R&D facility for Vertigro technology applications and projects in Europe.

Glen Kertz, CEO of Valcent Products, says: 'This joint venture company is the first of many commercial applications of the Vertigro technologies overseas, which will form the basis of rapid development within Europe and Africa.'

Construction of the pilot plant is expected to begin in late 2007. Under the terms of the agreement, SGC will build additional large commercial-scale facilities in Portugal as well as other countries in Europe, and in Africa. As Vertigro algae thrives on the absorption of carbon dioxide, the plants will be constructed near major sources of carbon dioxide emissions.

'We are excited to team up with one of the world's leading providers of algae-to-biodiesel feedstock technology,' remarks Vianney Vales, CEO of SGCEnergia. 'This agreement is a significant milestone for SGCEnergia's planned production of second generation biofuels.'

According to recent Frost and Sullivan research, approximately 9.5 million tonnes (224 million gallons) a year of biodiesel are required to meet EU's directives.

Goldman Sachs invests in Brazilian biofuels

US investment bank Goldman Sachs is set to invest 400 million reais (€156 million) in Brazil's second largest sugar and ethanol producer Santelisa Vale.

Santelisa Vale will process 18 million tonnes of sugarcane this year. The company also has plans for six new sugar mills, with a capacity to crush 2.5 million tonnes of cane each – a total of 15 million tonnes.

It also has a 72% stake in Crystalsev, a company involved in the commercialisation of sugar, ethanol, and electricity, with investment in a specialised ethanol terminal.

'Goldman Sachs brings the necessary expertise for us to leverage our growth plans in the coming years,' Santelisa Vale, CEO Anselmo Lopes Rodrigues, says.

Santelisa Vale has five mills in Brazil. Four of the new mills will be built in partnership with private equity funds in Companhia Nacional de Açúcar e Àlcool (CNAA), three of which will be located in Minas Gerais and one in Goiás. The other two new mills are Santa Vitória (in Minas Gerais), in which the company holds a 72% stake, and Tropical (in Goiás), with a 50% stake.

Shiyali@bigstockphoto.com

Santelisa Vale was formed as the result of a merger in July between Vale do Rosário and Usina Santa Elisa.

Lurgi supports Chinese biodiesel project

A project that aims to produce up to 100,000 tonnes of biodiesel a year in China's southwestern Guizhou province will be officially initiated this year, with technical support provided by Germany-based Lurgi, a plant contracting and engineering process company.

It will be one of the major projects under the China-Germany renewable energy cooperation framework.

A biodiesel intermediary test production line has been established, which produces 300 tonnes a year, based on domestic technologies.

It can produce biodiesel with a combustion value marginally greater than home-made biodiesel, and an emission standard up to Euro IV.

Two pilot biodiesel production facilities with an annual production capacity of 10,000 tonnes and 20,000 tonnes are on trial in the province.

Guizhou is the largest energy exporter in southern China, and plans to develop new type bio-energy such as tung oil, on the basis of developing coal and electricity.

Abengoa Bioenergy boosts Brazilian bioethanol presence

Abengoa Bioenergy, a subsidiary of diversified Spanish energy company Abengoa, has signed an agreement to acquire the total capital of the Dedini Agro group of companies for €216 million.

Dedini Agro is one of the companies in the Brazilian bioethanol and sugar market. It is dedicated to the cultivation and processing of sugarcane and the production of bioethanol with two production facilities in the State of Sao Paolo.

Abengoa Bioenergy's acquisition introduces it to one of the world's major bioethanol markets with a 2006 annual production of 17,500 million litres.

It is now the only company to be present in the world's three major bioethanol markets: the US, Brazil and Europe. Following the integration of Dedini Agro, Abengoa Bioenergy aims to increase production levels at the existing facilities in Brazil, to develop a new facility, and achieve more effective international marketing of the bioethanol produced in Brazil.

Abengoa Bioenergy will increase production by using the cellulosic bioethanol technology it is developing.

Abengoa Bioenergy's facility in Kansas

California Air Resources Board adopts 10% ethanol blend

The California Air Resources Board has announced it will adopt a resolution stating that all refineries producing petrol sold in the state will have to blend in 10% ethanol.

The move coincides with the new Low Carbon Fuel Standard (LCFS) set by Governor Arnold Schwarzenegger to take effect in late 2009.

'Today's decision by the Air Resources Board is an important step toward diversifying California's fuel supply with alternative and, in this instance, renewable fuels. While many alternative fuels exist in the market, ethanol is one that can be blended into today's petroleum with no change to our current cars,' Schwarzenegger says.

Schwarzenegger's goal is to lower greenhouse gas emissions by moving energy consumption from fossil fuels to renewable energy sources like ethanol. By 2020, policymakers expect at least a 10% reduction in the carbon content of fuels, the replacement of 20% of fossil fuels with lower carbon alternatives and expansion in the state's renewable energy market.

The demand for biofuel in California, the world's fifth largest economy and the country's largest consumer of fuel, could double as a result of the ruling. Last year the state consumed approximately 1 billion gallons of ethanol.

Soybeans could be Indiana's alternative fuel

Indiana Clean Energy is due to begin construction on a $90 million (€67 million) plant to turn soybeans into alternative fuel in Frankfort, Indiana.

The plant, which is the company's first since establishing in 2005, has a planned production capacity of 80 million gallons.

Murray Gingrich, CEO of Indiana Clean Energy, says the company wants to work with farmers in the area to provide soybeans for the plant.

Progress since the county Board of Zoning Appeals approved the project in June 2006 has been hindered by permit complications.

Vermont opens first biodiesel mixing plant

Robinson Oil Terminal has opened Vermont's first biodiesel mixing plant at its bulk plant in Essex Junction.

The plant will produce biodiesel by mixing traditional home heating oil with vegetable oil.

The fuel will be sold to oil companies in the area. 'It's new, but it's needed,' Robinson Oil Terminal owner Oeschger says. 'We're trying to work with the environment and keep Vermont green and this is a good start.'

Dealers say they plan to move slowly, experimenting with the mix of heating oil and vegetable oil.

Some dealers have had to install heated storage tanks because pure biofuel thickens in cold weather.

Ethanol production up in Africa

Ethanol production in Africa increased by 60% in 2006, from 100 million gallons to 160 million, according to a report from a regional forum on biofuel in Addis Ababa, Ethiopia.

The report also showed that Africa's ethanol production remains low against high demand.

Ethanol Africa, a South African company, has started construction of a bioethanol plant, using maize, with plans to build a further eight plants. The first plant will produce 158 million litres of bioethanol annually by processing 375,000 tonnes of maize. The plant will also have the potential to produce 108,000 tonnes of animal feed.

The company is assisting farmers to produce maize for ethanol production. Approximately 100,000 hectares of maize would be contracted at each plant.

This initiative could supply up to 12.5% of the country's fuel needs by 2015. South Africa has 3 million tonnes of surplus white maize which could provide a feedstock for the bioethanol industry, the report found. Ethanol projects in Africa aim to reduce the continent's expenditure on oil imports.

Bioethanol plants in Africa are mostly found in South Africa, Malawi, Swaziland, Mauritius, and Zimbabwe. Ethiopia and Kenya are also commercial ethanol producers.

The global production of ethanol in 2006 reached 20 million tonnes, according to BP.

Marketing Year	Production ('000 t)	Consumption ('000 t)	Surplus / Deficit ('000 t)
1992/93	2,955	7,022	-4,067
1993/94	9,077	6,828	2,249
1994/95	12,067	6,773	5,294
1995/96	4,406	6,417	-2,011
1996/97	9,694	6,842	2,852
1997/98	9,582	6,738	2,844
1998/99	7,203	6,383	820
1999/00	7,461	6,341	1,120
2000/01	11,001	6,785	4,216
2001/02	7,447	6,924	567
2002/03	9,732	7,751	1,981
2003/04	9,391	8,299	1,092
2004/05	9,482	7,956	1,526
2005/06	11,450	8,210 *	3,240

* Projected

Production and consumption of maize in South Africa

Source: Ethanol Africa

National Express drives away from biofuels

UK transport group National Express has discontinued a biodiesel trial after scientific studies showed that harm would be caused to the environment if the bus network started to run on biodiesel.

Richard Bowker, CEO of the coach, bus and rail group says: 'Biofuels may well have a role to play in helping us reduce greenhouse gas emissions arising from transport operations in the future, but based on the evidence today I think it is vital we wait for issues relating to the sustainability of supply to be resolved before we press ahead with biodiesel trials.'

The biofuels study highlighted that biofuel production from crops including sugarcane and rapeseed could destroy natural habitats and push up food farming costs in some developing countries.

National Express adds that carbon emissions could be higher than from traditional oil due of the intensive farming methods needed for its production. However, it remains interested in second generation biofuels that use non-food crops such as shrubs, straw and wood chips.

The National Express trial initially set out to convert its UK buses to run on 30% biodiesel. The fleet of coaches emits approximately five times less carbon dioxide per passenger than cars.

First biodiesel facility planned for Romania

US biodiesel production technology group Greenline Industries and Romanian vegetable oil producer Ulerom Vaslui will construct and operate Romania's first biodiesel facility.

This will be the first of its kind in eastern Europe. The facility will produce 7.5 million gallons (approximately 25,000 tonnes) of biodiesel a year. The project will use Ulerom Vaslui's upgraded rapeseed, sunflower and soy oil production facility. The company processes approximately 12,000 tonnes of seeds a month.

The Greenline group has 26 plans under contract with outputs ranging from 3 to 60 million gallons of biodiesel a year. The company's involvement in Romania will help the country to comply with EU standards of 2% biodiesel input in petroleum products, and the EU's 2010 target of 5.75% biofuels in the EU fuel supply.

Sincerity, fairness, commitment, responsibility, reliability and vision are the characteristics which lend our services a distinctive human profile.

More than just mechanical engineering.
Harburg-Freudenberger considers itself as a partner providing know-how and innovation for economic production solutions in line with market requirements – **for example in oilseed processing**.

This includes components, equipment and entire systems for

- Cleaning
- Cracking
- Flaking
- Conditioning
- Treating

With us as your technology partner you are always one step ahead.

Innovation is a tradition:
Machines, equipment and systems for the oilseed, food and tire industries, as well as for the rubber industries.

We are your technology partner providing you with 150 years of know-how.

Contact us to find out more!

HARBURG FREUDENBERGER

www.harburg-freudenberger.com

HF Rubber Machinery, Inc.
1701 N Topeka Blvd.
Topeka, Kansas 66608 - 0250, USA
Phone: +1 785 235 - 2336
Fax: +1 785 235 - 1331

HF Rubber Machinery, Inc. Akron Office
103 Western Ave.
Akron, OH 44313, USA
Phone: +1 330 864 - 0800
Fax: +1 330 864 - 5941

Harburg-Freudenberger Maschinenbau GmbH
Division Edible Oil Technology
Seevestr. 1 · 21079 Hamburg · Germany
Phone: +49 40 77179 - 0
Fax: +49 40 77179 - 325

Kittiwake introduces onsite biodiesel test kit

Kittiwake, a UK-based quality testing equipment company, has introduced its onsite biodiesel test kit.

The Kittiwake biodiesel test kit allows users to determine: water content (of stock oils and biodiesel), density (of biodiesel), viscosity (of biodiesel), total acid number (of biodiesel), acid content (of stock oils, for catalyst optimisation), and visual quality.

Biodiesel manufacturers and end-users can ensure the quality of the base stock at the time of delivery, optimise the ratio of chemicals used, refine and trouble-shoot the manufacturing process, monitor the consistency of the biodiesel from batch to batch and check stored biodiesel for any deterioration over time.

The test kit is designed to complement laboratory test results and reduce the frequency of laboratory analysis.

Aspectrics to launch biofuels analysers

Aspectrics, a California-based company that provides analytical instrument solutions for photometrics will launch a new range of biofuels analysers in October this year.

The company will launch the new encoded photometric near infrared (EP-NIR) 2750 and EP-NIR 2750i analysers to meet the demands of scientists working in the biofuels industry.

Users are able to monitor their processes in real time with the scanning rate of 100 scans/second and spectral range of 128 photometric channels.

Using the comprehensive at-line system, the EP-NIR 2750i biofuels analyser has been developed to allow users to carry out biodiesel quality control and analyse biodiesel blend percentages in real time, providing fast and efficient results.

The 2750i incorporates Aspectrics EP-NIR technology, the new Aspectrics eCalTransfer capability and an integrated sample interface.

Aspectrics' new eCalTransfer capability allows a calibration carried out on one system to be transferred to another without needing to recalibrate. The new touch screen LCD displays sample results in real-time.

Aspectrics' at-line packages come complete with a MultiComponent spectrometer, instrument control and data processing software as well as an optimised sampling accessory or method development bench.

Encoded Photometric Infrared (EP-IR) spectroscopy is a breakthrough for the process monitoring industry, providing ultra fast sampling capability (100 Hz) for multi component analysis.

BDT helps Brazilian jatropha biodiesel to turn commercial

Brazil's first commercial jatropha biodiesel project will go into operation this month following the delivery of BioDiesel Technologies' (BDT) processing unit.

BDT will deliver a further four processing units to increase the plant capacity to 40,000 t/y by the end of the year. The multi-feedstock technology provided by BDT will also allow the use of animal tallow for the manufacture of biodiesel.

Local cooperatives and small farmers in the state of Tocantins will supply the biodiesel facility with the required feedstock, working with the project operator, Compahnhia Productora de Biodiesel de Tocantins. The creation of 48,000 hectares of jatropha plantation will improve the local agricultural community.

Brazil has introduced mandatory blends of 2% by 2008 and 5% by 2013 as well as numerous tax incentives for biodiesel producers that source their feedstock from local communities.

Compahnhia Productora de Biodiesel de Tocantins is investigating potential sites for two projects within the region, taking total regional production to over 120,000 tonnes of biodiesel a year.

Michael Smith Engineers upgrades biofuels pumps

Michael Smith Engineers, a UK-based pump specialist, has upgraded its range of Liquiflo pumps suitable for use in biofuels production.

The Liquiflo range operates on packaged type plants where the pumping duties involve the combination of low flow and relatively high pressures. For transferring larger flows at lower pressures, centrifugal pumps, such as the Dickow KM series, are used.

Many of the pumps Michael Smith Engineers supplies for biodiesel applications are of a seal-less design, essentially due to the requirements for leak-free pumping by its customers.

The Dickow range pumps vegetable oils, methanol, crude and refined biodiesel. Diaphragm dosing pumps have been supplied for accurate metering of sodium methoxide and sulphuric acid for pH correction.

Smaller, lower cost biofuels process installations have been supplied with Thompson KC series pumps in PVDF to ensure ATEX certification.

These have successfully transferred vegetable oil, methanol and biodiesel at relatively low pressures and low flows. ●

Achieving economies of scale in biodiesel production

UK-based biodiesel specialist Filtertechnik has expanded the scale of its biodiesel purification systems.

From WVO filtration, through to dry wash solutions and final polishing systems with online traceability, Filtertechnik's product offering allows producers of all sizes to benefit from increased production and superior quality.

The larger capacity purification systems are designed for producers with greater volume requirements. These are continuous duplex systems, whereby a set number of wash towers are active, while the second set is being discharged.

Once the initial wash bank is fully charged, the flow is diverted to activate the second bank of wash towers, thereby eliminating production downtime ensuring no interruption to production and significantly reducing purification times. These systems can be designed, sized and built to suit most production capacities and facility layouts.

Filtertechnik's systems eliminate production bottlenecks caused by the time constraints in water washing and using water softeners such as ion exchange resins to purify biodiesel. Whereas biodiesel would take days to purify using water and water softeners, Filtertechnik's Magnesol wash and final polishing system takes a fraction of that time.

The problem with biodiesel purification used to be that only producers of a certain scale were compatible with drywash methods.

Filtertechnik has always enabled producers to achieve levels of purity which can conform to standards. With online particle counting and data logging, producers can ensure traceability and implement quality systems such as the biofuel specific BQ9000, to which Filtertechnik is the UK's first registered auditor.

Because the biofuels industry is still in its infancy it cannot be disputed that consumer confidence is low. BQ9000 is the biofuel specific incarnation of the business quality management system ISO9000.

Filtertechnik, along with the US National Biodiesel Board, is leading the way in biodiesel quality in the UK and Europe. BQ9000 audits will soon be available from Filtertechnik and will enable producers of quality biodiesel to be recognised as professional fuel producers and also accredited marketers for companies which wish to ship and blend biodiesel under an accredited quality system.

BQ9000 incorporates good working practices with laboratory and in house testing, which is essential for the biodiesel industry. ●

Feedstocks of the future

The European Bioethanol Fuel Association (eBIO) compares which feedstocks will be most prominent in the biofuels market in years to come

Renewable energy sources are currently on the very top of the European agenda with a commission's proposal for a comprehensive directive on renewables waiting in the pipeline. As agreed at the European Council Spring summit earlier this year, Europe is heading for a 20% share of energy derived from renewable sources.

For the biofuels sector the European Union (EU) has already politically agreed on a binding target of a minimum of 10% by energy content for 2020 for every single member state. The bioethanol production would have to increase more than tenfold to between 18 and 20 billion litres in 2020 to meet the 10% target. But before the 10% target can be achieved there is still the 5.75% target to be achieved by 2010, with an estimated potential bioethanol need of 11.6 billion litres. Both the 5.75% and 10% target require a boost in production capacity, which is closely linked to the feedstocks used for the bioethanol production in Europe.

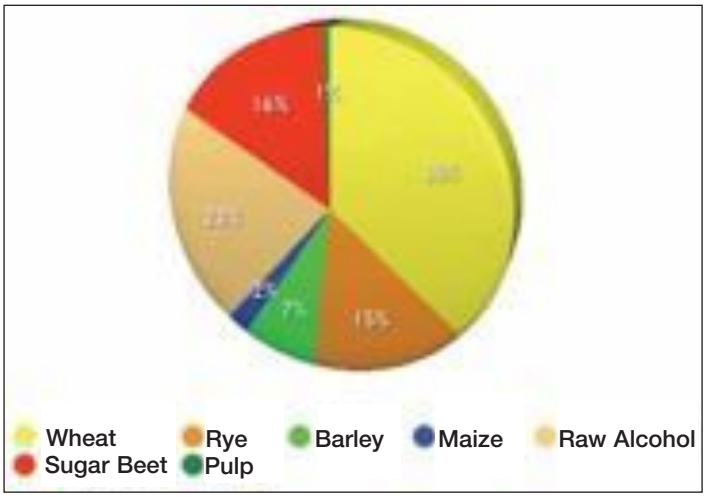
Present situation – cereals are leading

In 2006 the EU produced close to 1.6 billion litres of ethanol for fuel. The major share of this was distilled out of cereals, which count for 976 million litres or roughly 61% of total ethanol feedstock. Among the different grains used for the ethanol production, wheat is the most important cereal with a market share of 36%, which equals 580 million litres, followed by rye (243 million litres or 15%). Barley also serves as a feedstock and accounts for 7% (119 million litres) of the total EU production. Maize accounts for only 2% or 34 million litres. Finally, for triticale (a man-made hybrid of rye and wheat) which serves as a marginal feedstock primarily in Germany, the precise volume is difficult to estimate.

Besides the grain-based ethanol production, the upgrading of raw alcohol (mainly wine alcohol) also plays an important role in the European ethanol market. In 2006 it had a share of approximately 353 million litres or roughly 22% of the total production. Sugar beet serves as another ethanol feedstock with 253 million litres (16%) produced from it. Sweden is currently the only country which produces 10 million litres of fuel ethanol out of pulp. In addition to the domestic production the EU-25 (EU member states minus Bulgaria and Romania) imported 233 million litres mainly from Brazil, where sugarcane is traditionally used as a feedstock.

Raw material use by member state

The biggest bioethanol fuel producer in 2006 was Germany with an overall output of 430 million litres. The main feedstock used for the German ethanol production is rye, which



Origin of domestically produced bioethanol in 2006 for the EU-25

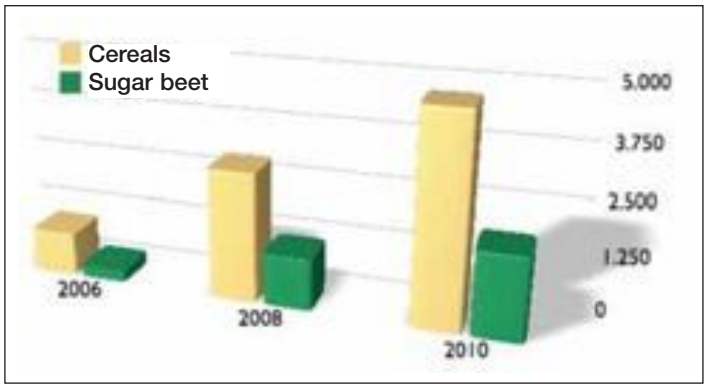
accounts for 213 million litres (49.5%) followed by wheat, which accounts for 178 million litres (41.3%). Barley contributes 8% (35 million litres) to the German production followed by triticale (no precise numbers). Wine alcohol is also used as a marginal feedstock with only a 0.9% share of total production.

Spain, as the second biggest producer (396 million litres in 2006), mainly processed wheat, which accounted for 227 million litres of the total production (57%), followed by wine alcohol, whose upgrading leads to 85 million litres output of bioethanol. The rest of the Spanish production came from barley with a share of 21% (or 84 million litres).

In 2006, France produced 293 million litres of ethanol and was the only large scale producer of bioethanol coming from sugar beet with an output of 238 million litres (around 81%); sugar beet is traditionally the main feedstock for French production. Although French farmers grow a considerable amount of wheat, only around 50 million litres (17%) of the total output is derived from wheat. The upgrading from wine alcohol accounts for some 5 million litres, which equals less than 2% of the domestic production in France.

Sweden, one of the most advanced consumers of ethanol in the EU, produced roughly 65 million litres domestically with grain as a major feedstock and pulp from trees. Another important feedstock is wine alcohol from Spain, France and Italy. A total of 105 million litres was purchased, of which at least 75 million litres was upgraded in Sweden itself. The remaining demand (for E85 use) is satisfied by imports from Brazil.

Poland is the most advanced new EU member state regarding the production of ethanol with an overall output of 161 million litres in 2006. Estimations allocate 17 million litres to wheat whereas the remaining 90% are distilled in small scale manufactories processing raw alcohol into fuel ethanol. In the other new member states, ethanol production is even more in its infancy: Hungary produced about 34 million litres of ethanol from maize, the Czech Republic 15 million litres from



Estimated rise in cereals and sugar beet consumption in fuel alcohol based on production capacity currently under construction (in billion litres)

sugar beet, the Baltic states, Lithuania and Latvia processed 80,000 tonnes of rye into fuel alcohol and the Netherlands produced 15 million litres from a starch waste stream.

Medium term prospects (until 2010)

In the run up to 2010 there will be a change in the ratio of the classical feedstock cereals versus sugar beet. Instead of only two countries which are now using sugar beet as a raw material, at least three more countries will start using this feedstock within two years. This increase in sugary feedstock use is to a large extent due to the dismantling of the EU sugar regime. As a result of this reform less sugar can be sold to the world market, which forces farmers to look for new outlets or grow different crops all together.

Several beet-fed distilleries are under construction, some of which will start operating this year. The first one will be British Sugar in the UK. Its 70 million litre a year plant is expected to start operating this summer. The next country where sugar beet will be added as a feedstock is Germany. The German company Nordzucker plans to go on-stream as of October this year and produce about 130 million litres of ethanol from sugar beet and thick juice. Next year CropEnergies will also use sugar beet at the German Zeitz plant. The construction of an additional 100 million litres a year is progressing well. Danisco recently started the construction of a medium-sized sugar beet-run plant in Anklam, Germany, with an announced production capacity of 52 million litres a year plant.

Also under construction is the CropEnergies plant in Belgium (Wanze). It will be a multi feedstock plant processing both wheat and sugar beet with a production capacity of 300 million litres. This makes the Wanze plant, which is jointly run by Tirelemontoise and CropEnergies, one of the biggest ethanol plants in the EU. Another country where the use of sugar beet will increase is the Czech Republic. There, Agroetanol TTD is expanding its current capacity from 20 million litres to 80 million litres next year. In total by the end of 2008 there will be an additional production capacity for sugary feedstock of around 900 million litres.

Beyond 2008 we can expect some new plants in Greece (Hellenic Sugar Industry SA), the Netherlands (Royal Nedalco) and Spain (Ebro Puleva) that will use sugar beet as feedstock. Their total production capacity is estimated to be 700 million litres. Despite this extension of domestically grown sugary feedstock for ethanol production, wheat will stay the major feedstock also for the medium term. Wheat consumption in fuel alcohol will rise by 44% to around 2.5 million tonnes with significant increases expected in Germany and France. Currently there are approximately 1.4 billion litres of additional production capacities under construction for wheat, which should be operational by mid-2008. Maize is also on the rise with an additional processing capacity of around 500 million litres.

The forecast for 2010 underlines the constant rise of cereal feedstock in the total ethanol fuel production, which will need to grow to between 11 and 12 billion litres in order to reach the target of 5.75%. Maize and wheat will see the most important growth rates while barley and rye on the contrary are being estimated to stagnate on their current level. In total one can expect 4.6 billion litres of ethanol coming from cereals whereas sugar beet consumption will rise to 1.9 billion litres. Additionally, the upgrading of wine alcohol as one source of fuel ethanol production is going to decrease further and will finally be substituted by a less cost intensive feedstock.

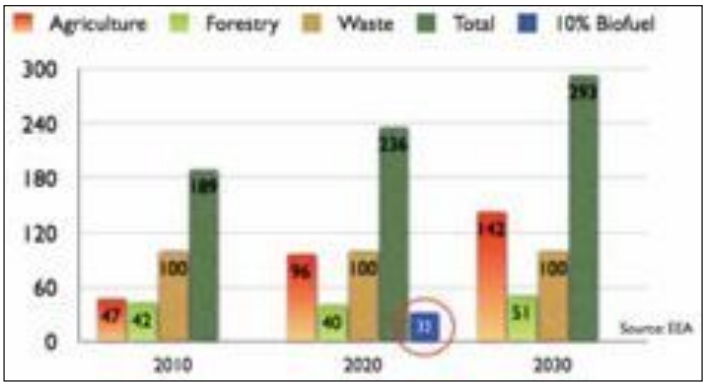
A second change in feedstock use in the next few years is the increased use of waste streams or cellulosic material. It is too early to make reliable forecasts on expected volumes but the industry will integrate these kinds of raw materials. The first steps in this direction have already been taken by Swedish SEKAB, which produces ethanol from wood pulp. In Spain an additional 5 million litres are also planned to be extracted from cellulosic feedstock by Abengoa Bioenergy at its Biocarburantes Castilla and Leon plant in Salamanca next year. In the Netherlands Royal Nedalco plans to launch its 200 million litre plant eventually processing lingo-cellulose into ethanol by 2009. Denmark and Sweden run small cellulose-to-ethanol pilot plans.

Long-term prospects (from 2010 to 2020)

During the next decade there will be an increased use of dedicated feedstock for energy production. This can be both traditional raw materials such as wheat, but with a higher starch content, or residues from traditional crops now considered to be waste. There will also be an increased use of energy crops that cannot be used for food production. Once the technology is mastered to digest the dedicated energy feedstock there is an abundance of biomass to be used. The European Environment Agency (EEA) made a projection for the sustainable biomass potential in the EU-25. By 2020 the target of 10% biofuel would require 32 million tonnes of oil equivalent (biomass) or 13.5% of what will be available by that time. ●

This article was written by Gloria Gaupmann and Rob Vierhout, from the European Bioethanol Fuel Association (eBIO).

Various sources were used for writing this article: industry sources (eBIO members), European Commission, EU Management Committee on Cereals, F.O. Licht World ethanol & biofuels report vol. 5, nr. 16, ZMP.



EEA projection: EU-25 sustainable biomass potential in energy content in million tones of oil equivalent

Fighting off negative publicity

Biofuels have received a whole raft of bad press in recent months – but is any of it deserved?

Earlier this year a UK free commuter newspaper, Metro, carried the headline, 'Biofuels are not our saviour'. The piece followed the release of a UN report on sustainable energy and quoted Friends of the Earth campaigner Ed Matthew who said: 'We are struggling to feed people and suddenly we want to start feeding our cars on crops. If this is done it could cause dramatic social and environmental problems.' Almuth Ernstig of Biofuelwatch also said: 'Food security, local communities and bio-diversity are all under threat.'

This year has seen the public debate move rapidly from the situation in which biofuels were seen as the answer to carbon emissions from transport fuels. Now the rush towards biofuel production is portrayed as diverting land from growing food crops, depriving the hungry of food, pushing up food prices and causing untold ecological damage in countries growing crops such as soya and palm for biodiesel production.

Headlines such as: 'Surge in biofuel production pushes up food prices', 'Corn will not save the planet', 'The Biofuel Timebomb', and 'The Great Green Con' have all contributed to the overall impression that biofuels are now a bad thing. It seems the NGOs believe that the UK government's pursuit of targets for inclusion of biofuels under the Renewable Transport Fuel Obligation (RTFO), and the EU's targets of 10% voluntary inclusion by 2010, and 10% obligatory by 2020, is poorly thought out. As such, the introduction of these targets is currently being opposed by a number of them.

Devon@bigstockphoto.com

Biofuels are not always portrayed positively in the media

However, positive slanted pieces did appear in July in *The Times* in the UK on the use of jatropha for biodiesel, highlighting UK-based biodiesel producer D1 Oils' plans. The UK Sunday Times also explained how growing crops for biofuels was helping to put one farmer back into profitability.

These are possibly the first signs of fight-back on behalf of the growers and processors, which believe that biofuels can be produced in a sustainable way, without damaging the environment, and providing exactly the kind of greenhouse gas savings which are needed to help to meet climate change targets.

The problem is that there are no simple solutions in transport fuel, any more than there are in similar areas of energy production or with regard to other green issues. To suggest that increasing production of crops for biofuels is the only reason for rising prices of cereals on the world markets is quite clearly nonsensical, as is the suggestion that price rises in these areas will lead to major rises in food prices.

It is clear that NGOs have very real and understandable concerns about rising biofuels production boosted by governmental targets, if there are no checks and balances in place to ensure sustainability. However, there are many people in these organisations who see both sides of the coin: there are reasons to promote biofuels, and there are reasons to proceed with caution.

The big danger for the biofuels industry in Europe is that it will be damaged forever by the confusing messages emerging from the media. What can consumers, opinion formers and investors really believe about biofuels? And will poor communications prevent the industry establishing itself in a way that will make future technologies, such as second generation biofuels, viable when they do arrive?

The idea being promoted by some organisations is that we can simply move on to these technologies without having the infrastructure and supply chain provided by conventional technology in place. However, it seems likely that such a strategy will delay the introduction of biofuels by many years.

The Ceres Partnership has been working with Home-Grown Cereals Authority (HGCA) in the UK for a number of years to publicise the work it has been doing to support accreditation and assurance for biofuels. This work has not only demonstrated the very real savings in greenhouse gas emissions which are possible, but also helped to set the framework for the assurance scheme, which will be necessary for the RTFO when it takes effect next April.

Working alone it is difficult to see how any organisation can mount a campaign that would begin to communicate the facts, and bring balance to this argument. However, working together the industry could at least provide reliable sources of factual information, and point the media in the direction of the many credible academics and other experts, who can demonstrate how biofuels can be a genuine part of the solution without creating more problems than they solve.

The next 12 months will be a critical time for biofuels, and the media will undoubtedly play a major part in deciding the outcome. Now is the time to act if the industry is to ensure that it gets its message across.

This article was written by:
Peter Crowe, director, the Ceres Partnership, a communications consultancy working across the cereals supply chain, and involved with the promotion of biofuels for a number of years.

sbz corporation

The premier supplier of biofuel & fuel additives

Stability Additives • Antioxidants • Biocides • Corrosion Inhibitors • Denaturants • Demulsifiers • and more...

sbz corporation

www.sbzcorporation.com
sales@sbzcorporation.com

P.O Box 8105, Bloomfield Hills, MI 48302, USA

Tel: 1-248-539-8072 • Fax: 1-248-539-3162

Woodland Place, Hurricane Way, Wickford, UK, SS11 8YB

Tel: +44-1268-761504 • Fax: +44-1268-761508

Why some southern are choosing not to

Although many producers' efforts are being hampered by climatic conditions, the growing demand, as well as stringent legislation, is enabling the region to flourish

by Luke Buxton

Northern Europe is renowned for its beer, whereas southern Europe is better known for its wine. But both vineyards and barley fields alike are now attracting the attention of biofuels producers throughout the world.

The reasons for this are largely economic. Grape growers are looking at whether there is more money in ethanol fuel than there is in wine, and the price of beer in Germany looks set to rise by 40% this year as farmers put more effort into growing barley for alternative fuels.

The surge in biofuels production in southern Europe, however, cannot solely be put down to new biofuels feedstock research. Other factors including policy, climate and foreign investment, also play a part.

Hitting targets

Biofuels production in any country is in the most part driven by government targets and legislation. The EU Directive 2003/30/EC aimed for a reference value of 2% blend of biofuels by the end of 2005. This is calculated on the basis of energy content, and is for all diesel and petrol transport use. By the close of 2010, this value will be increased to 5.75%. Stephanie Ho, project manager at the European Biodiesel Board (EBB) explains that the 5.75% from the directive is an indicative, not a requirement.

The national indicative targets on biofuels throughout the southern states are generally not being met at the moment, making the 2010 target seem elusive. 'The main reason for some of these countries producing on a slower scale is because of legislation,' explains Ho. 'Without having this in place the industry is not feasible.'

Some countries such as Portugal and Slovenia have progressive targets of around 1% more each year until 2010, while Hungary, Malta and Spain have not yet reached a 1% biofuels replacement of traditional transport fuels, according to the 2005 data.

Italy's national indicative target had caused some controversy, as it was set below the 2% reference value. But the new 2007 budget law from December 2006 brings Italy into conformity with the EU Directive on biofuels. Italy's national directive is now 2.75% by the end of 2008, and 5.75% by the end of 2010.

Tax incentives

Smaller member states such as Cyprus and Malta focus on biofuels usage primarily for the government, with some support schemes improving incentives for biofuels production. Spain, the largest bioethanol producer in southern Europe, has a total

National biofuels legislation and targets (data for 2005 unless otherwise stated):

Country	National indicative target	Taxation situation
Cyprus	1%	The government is considering using biofuels for its captive fleet. €1200 will go towards the cost of purchasing new flexible fuel vehicles (FFVs)
Greece	1.1%	An initial exemption of 51,000 kilolitres to 114,000 kilolitres produced in 2007. The law has been sent back for review to the Attorney-general this summer and awaits a Supreme Court ruling
Hungary	0.4-0.6%	Until December 2010, fuel distributors will be able to claim a refund of the excise duty on EBTE produced for bioethanol and also on biodiesel Tax concession applies to promote a maximum blend of 5% biodiesel into diesel
Italy	1%	Reduced rates of bioethanol excise duty. Bioethanol produced from agricultural products and ETBE produced from agricultural alcohol are €289.22 per 1000 litres
Malta	0.3%	The government has launched a support scheme through exemption of tax duty, estimated at €412,000
Portugal	2006: 2% 2007: 3% 2008-2010: 5.75%.	Fiscal measures to promote the use of biofuels were laid down in a decree in 2006, which provides a total or partial exemption from excise duty for these fuels up to a quota set annually
Slovakia	N/A	Bio-components blended with fossil motor fuels not exceeding 5% esters, or 15% ETBE, are subject to no excise duty
Slovenia	2007: 0.7% 2008: 2% 2009: 3% 2010: 3.5%	When biofuels are added to fossil fuels, a maximum 5% exemption from the payment of excise duty can be claimed
Spain	2006: 0.55% - 0.65%	Until December 2012, no tax will apply to biofuels

Source: European Commission

European countries drink the profits

exemption of tax on biofuels in force until a year after the EU Directive deadline.

Italy, the leading biodiesel producer, has particular tax levels for bioethanol and ETBE. New taxation changes mean that the biodiesel tax relief quota has been increased from 200,000 to 250,000 for 2007. The quota was 300,000 tonnes in 2004, reduced to 200,000 tonnes because farmers were not benefiting.

For bioethanol, the 2007 budget law extended the annual benefit for production to 73 million through to 2010. Bioethanol production is to be taxed at less than 50% of the normal rate, but the European Commission has not yet approved this tax plan.

Choice of feedstocks

Raw materials are a recognised scarcity in the south. Each country is considering a number of different feedstocks, with the search sometimes taking them to local restaurants. 'In terms of having production potential the countries of the south are well adapted,' says Ho. 'For example, Spain works with used cooking oil. Each member state is adapting to its own environment.'

Spain is also using used soy bean oil and sunflower oil, similarly to Portugal. Spain and Portugal only started producing biodiesel when the directive was established in 2003. In 2005, 158.5 tonnes of biodiesel were produced in Portugal. The government's measures for March 2006 included the conclusion of agreements on the use of biodiesel in public passenger and goods transport fleets, with over 10% biodiesel incorporation into fossil fuels.

Portugal's neighbour Spain is one of the south's top players. Spanish power company Elecnor announced in July this year that it will build Spain's biggest biodiesel production plant, costing 70 million. The plant, on a 31,000 square metre site in the port of Gijon in northern Spain, will be ready in the spring of 2009 and will produce up to 500,000 tonnes of type EN 14214 biodiesel a year, from vegetable oil.

Spain imports biodiesel but in June 2007 this supply was threatened as the Spanish Renewable Energies Producers Association (APPA) protested against biodiesel imports from the US

With limited self-sustainability, southern countries are forced to rely on imports to keep the resources high in preparation for realising the biofuels potential. The Spanish government announced this summer agreements with Brazil to increase raw material imports. Spain already imports biodiesel from the US, but in June 2007 this supply was threatened as the Spanish Renewable Energies Producers Association (APPA) protested against biodiesel imports from the US. It claims the fuel is 0.20 cheaper than the cost of locally produced biodiesel, forcing local producers out of the market. The APPA has called for import tariffs in support of Spanish producers.

Further south, according to the national report for 2005, Greece will consider importing sunflower seed, cotton seed, rapeseed and used cooking oil for biodiesel. But 70% of imported oils are rapeseed and soybean oil.

Öko-Line's biodiesel factory

Öko-Line, a Hungarian biodiesel producer, recognises the country's ties to vegetable oil, but is also moving on to new feedstocks. Gergely Novák, head of business development at Öko-Line, comments: 'Vegetable oil has a long history, but biodiesel production is a relatively new thing in Hungary and we are looking forward to a boom in the market'. The company has two oil presses in operation, and another two will be built next year with the capacity to press 30,000 tonnes of rapeseed each annually. Öko-Line uses 120,000 tonnes of rapeseed each year. 'In the future we are looking to use sunflower seeds,' Novák says. 'Our target is to expand production to 70,000 tonnes.' By 2008, Öko-Line will produce 50,000 tonnes of biodiesel a year, far surpassing the EBB's 2007 estimate of 21,000 tonnes.

The Hungarian government will introduce a regulation in 2008, stipulating that oil companies must produce 4.4% of biodiesel out of all total fuel produced, in order to benefit from a discounted tax rate.

Biofuels production is present in Malta, one of the smaller European countries, but on a relatively small scale. Malta's Ministry for Resources and Infrastructure has begun using biodiesel fuel in its fleet of vehicles and heavy equipment. The government has already converted between 20-25 vehicles to run on biodiesel. During 2005, Malta produced 1.42 mega litres of biodiesel, of which 60% was for transport purposes, and 40% industrial.

Malta's potential for growing crops for producing biofuels is negligible due to limited agricultural land, high population density, poor soil fertility and limited fresh water resources – biofuels production requires large quantities of irrigation water. Agricultural resources are not used for biofuels, so the potential centres on waste cooking oil. In Malta biodiesel accounted for 0.52% of total fuel used for road transport in 2005, higher than the National Indicative target of 0.3%.

'With Malta and the smaller countries there is less demand,' explains Ho. 'In terms of feedstocks, they do not have as much opportunity to get rapeseed, but Malta has been producing and using used cooking oil.'

Another relatively small country Slovenia does have the potential to use raw vegetable oil, and the ministry of agriculture estimates 6,000 to 7,000 hectares are available for growing oilseed rape.

There are no petrol refineries in Slovenia, and biofuels produced suitable for blending with petrol are yet to be realised. Biofuels were blended with diesel fuel in a pilot project in Slovenia in 2004, with the biodiesel mostly being imported from other EU member states. Distributors are expected to start introducing biofuels in the main petrol stream this year.

Biodiesel production in the EU, 2006-7

North	Capacity ('000 tonnes)		South	Capacity ('000 tonnes)	
	2006	2007*		2006	2007*
Germany	2662	4361	Italy	447	1366
France	743	780	Spain	99	508
UK	192	657	Portugal	91	246
Austria	123	326	Slovakia	82	99
Poland	116	250	Greece	42	440
Czech Republic	107	203	Slovenia	11	17
Denmark	80	90	Romania	10	81
Belgium	25	335	Bulgaria	4	65
The Netherlands	18	115	Malta	2	8
Sweden	13	212	Cyprus	1	6
Lithuania	10	42	Hungary	0	21
Latvia	7	20			
Ireland	4	6			
Estonia	1	35			
Finland	0	0			
Luxembourg	0	0			
TOTAL	4101	7432	TOTAL	789	2857

*Estimated production levels

Source: European Biodiesel Board

Outside investment

Many southern European companies benefit from foreign investment. Greenline Industries, a US-based biodiesel company, is involved with biodiesel facilities in Romania. The company has three plants in the country, one is actively producing and the others are under construction. The first plant is capable of producing 7 million gallons of biodiesel a year, which will stay in the area. 'It was up and running in seven months,' Peter Brown, head of sales for Europe, declares. 'Other companies take two to three years. The next plant we will build will produce 10 million gallons and will be built next door to the first.'

Bulgaria's biofuels portfolio from external investors is also getting heavier, particularly from Europe's biggest biofuels producer Germany. German investment fund ICS International Consulting plans to invest 320 million in the construction of six biodiesel plants that will recycle household and animal waste into biodiesel fuel in Bulgaria. The project is expected to begin in October 2007 and the plant should begin operation in early 2008. Each plant will produce 60 to 80 million tonnes of biodiesel a year.

Another German company, Verbio Vereinigte BioEnergie, one of the biggest biofuels producers in Europe, is considering plans to invest up to 100 million in a biofuel production facility in Bulgaria. If Verbio goes through with the plan, it would produce both biodiesel and bioethanol, making Bulgaria a major source of biofuels in southeastern Europe.

Bulgaria has also attracted the interest of Spanish bioenergy company Green Fuels, which has commissioned a 70 million biofuels plant near Pleven. Original plans for the facility have been upgraded and the facility's annual production capacity will be 110,000 tonnes of biodiesel, more than double the previously planned 45,000 tonnes. To add to its biofuels presence in Bulgaria, Green Fuels will produce 60,000 tonnes of bioethanol in Pleven.

The expansion of Hungary's bioethanol sector, on the other hand, will be slower than

expected because many investors are not finding sufficient grain inputs. 'New projects requiring hundreds of thousands of tonnes of maize are being unveiled week by week, but few of these will actually be built,' says Imre Németh, Hungary's state secretary.

Part of this is due to recent drought. It would take about five years for Hungary to reach its goal of building 800,000 tonnes of bioethanol capacity, Nemeth remarks. Two firms make bioethanol in Hungary, Gyor Distillery and Hungrana, which is jointly owned by Austria's Agrana and UK sugar producer Tate & Lyle.

The combined capacity will reach 200,000 tonnes by the end of 2007. The third substantial project is situated at the site of a former sugar plant in Kaba which is run by Eastern Sugar, a joint venture of Tate & Lyle with Saint Louis Sucre, a subsidiary of Suedzucker. The plant in eastern Hungary will make an estimated 100,000 tonnes of ethanol from 300,000 tonnes of grain. Joining the race is Bács-Bio-Etanol, Hungary's own producer, which has announced it will construct a bioethanol plant in 2008. The factory will process 250,000 tonnes of locally produced corn a year.

Top three bioethanol producers in southern and northern Europe (in million litres)

North	2006	2007	South	2006	2007
Germany	165	431	Spain	303	396
France	144	293	Italy	8	78
Poland	64	161	Hungary	35	34
Total	373	885	Total	346	508

Source: European Bioethanol Fuel Association (eBIO)

Largest producers

Spain is the biggest bioethanol producer in southern Europe, with the efforts of Abengoa Bioenergy leading the way. Abengoa Bioenergy has three bioethanol plants in production in Spain with capacities of 100 million litres, 126 million litres, and 200 million litres (of which 12.5% will be made from wine distillation). The company operates two wine distillation plants with 50 million litres capacity each. Apart from barley and wheat, a pilot plant for the production of 5 million litres of bioethanol from lignocellulosic biomass (cereal straw) is also being built.

Italy is the largest biodiesel producer in southern Europe, and the second largest bioethanol producer, behind Spain. Italian biodiesel is produced mainly from imported rapeseed and soybean oil from other EU countries. Rapeseed accounts for 70%, soybean 20%, and the remainder from sun and palm oils. At the start of 2007 there were 10 biodiesel plants, with a further six to be operational by 2009. Total capacity will rise from 1.53 million tonnes to 2.14 million.

In 2006, bioethanol production in Italy rose to 1.28 million hectolitres obtained from alcohol produced from both the distillation of wine surpluses and molasses. Two bioethanol plants using corn have been operational for over 20 years with a combined capacity of 2.7 million hectolitres. Four further plants are planned for 2009, adding almost 10 million hectolitres extra capacity.

Verbio is one the biggest biofuels producers in Europe

Success outside the circle

Since the introduction of the EU Directive, member states have been steadily pursuing individual targets. Meanwhile the biofuels situation in non-EU countries such as Turkey and Serbia has been helped along by external investment, ensuring a similar biofuels output.

As a non-EU member, Turkey has no pressure to meet a set biofuels target, so external investment is vital. Saving Energy Corporation, a US biodiesel company, is teaming up with a local partner in Turkey. Georgy Norkin, project manager at Saving Energy's Turkey Group, says: 'Biofuels are not currently stable yet - the biggest problem is raw materials because there is not enough. There is no internal market so we need to import or switch to an alternative such as algae.' After the plant in Turkey is built,

within three years the company plans to use algae as a raw material.

Biodiesel produced from domestic raw materials in Turkey is exempt from a private consumption tax of 0.65 Turkish lira (0.35) per litre with a 2% blend. The main challenge for biofuel producers in Turkey is to promote biofuel usage as Turkey does not have a legal framework to make this compulsory. Therefore only some of the oil companies blend biofuels in order to qualify for the 2% excise tax waiver.

Norkin points out that the imposition of tax depends on where the biofuels production takes place. 'There are lots of free zones in the country; in those zones there will be tax breaks. If you import outside the free zones there could be a potential problem.'

The Saving Energy Turkey Group plant will be built in a free zone. There are incentives for local farmers that grow canola as a feedstock, and Saving Energy has construction agreements with partners to supply raw materials in the area.

While the biofuels output in Turkey's is under no obligation to comply with the EU's 5.75% target, the company is looking to reach that number eventually. 'We're promoting a huge capacity. It will be the biggest biodiesel production plant in Turkey. There are some companies on the market but not with such high capacity.' The company has established a joint venture with a local company to build a plant with an annual capacity of 265,000 tonnes.

Saving Energy is looking for a solid long term investment. 'We are also looking for potential partnerships with local companies familiar with the laws and the country,' says Norkin. The company imports rapeseed from the southern region of Russia to support the production cycle.

Bioethanol in Turkey, on the other hand, is something producer Tarkim handles singularly. The company has one operational production plant at Mustafakemalpasa-Bursa, with an annual production capacity of 40,000 m^3.

Both corn and wheat processed in the plant are grown locally, with an annual consumption of 100,000 tonnes.

'We do not import bioethanol,' Simin Emir, sales and marketing specialist, says. 'Depending on the demand, we expect, maximum, a quarter of our production levels to be exported. The future looks bright as Turkey is producing many agricultural products. The main problem is the lack of legal basis for promoting biofuel usage and an action plan for the upcoming years.'

Serbia gets prepared

With news that Serbia could join the EU in 2008, the readying of biofuels projects seems to be a clear move to meet the trends set by the EU for its member states. Serbia opened its first biodiesel plant in June this year with an annual production rate reaching 100,000 tonnes of biodiesel, which equates to 2% of Serbia's annual consumption of fossil fuels.

The biodiesel produced at the Victoria Oil refinery in Sid will come from local raw materials rapeseed, sunflower and soybean oils. Savo Vukicevic, head of the commercial department at the plant, says: 'Our basic target is the domestic market: big transport companies, big farms and petrol stations. For Serbia it means getting the fuel produced out of local raw materials. Its also important that it reduces dependence on imported fossil fuel.'

In September 2006, a group of eight Hungarian companies, a US firm and a German bank, started building Serbia's biggest bioethanol power plant. This will burn 1 million tonnes of wheat and 500,000 tonnes of maize, equating to almost 50% of Serbia's annual output of both crops.

The Hungarian-US consortium, Biotech Energy, will invest 371 million in building a bioethanol plant in the town of Zrenjanin, along with a port and other infrastructure. The project is scheduled for completion by the end of 2009, and represents the largest-ever green field investment in southeast Europe. The factory is expected to generate around 680,000 tonnes of bioethanol annually.

Future outlook

Lack of raw materials and recent droughts are having a specific effect on biofuels production in the southern European countries this year. But with a little help from outside, the market is growing. Bulgaria in particular has been attracting a large amount of investment interest from Germany and Spain, giving it the potential to become one of the main biofuels producers of the future, alongside Hungary.

With this external support, national initiatives and a growing demand, producers in southern Europe could soon be toasting their successes in the sunshine.

Tarkim will produce 100,000 tonnes of biodiesel from local raw materials

Register by September 15th and SAVE $300

platts Refined Products Storage & Transportation

Capacity Expansion, MLP Investment, Transportation Logistics

October 24–25, 2006 • Hilton Post Oak Hotel • Houston, TX

Storage capacity is a growing problem in the nation's ports and terminals. Demand for refined products continues to rise, as does the number of specialized feedstocks and blends that need to be stored and transported. In addition to capacity, getting the product to and from terminals is difficult with railroad limitations, high demand for barges, and the inability of ethanol to be transported through a pipeline.

This conference looks at how the industry is working to meet the demand. Investors with a heightened interest in the advantages offered by Master Limited Partnerships, along with long-term planning studies, are providing the support needed to fuel expansion. Railroad and barge companies are taking on transportation challenges. And terminal operators are preparing for the addition of new feedstocks.

Platts ***Refined Products Storage and Transportation*** conference, October 24-25, 2006 in Houston, TX features discussion on these critical topics:

- Overcome cost challenges to meet demand with storage expansion
- Predict long-term storage needs
- Master Limited Partnerships' role in growth and expansion
- Prepare for ULSD and biofuels
- Handle railroad and barge transportation challenges
- Regional outlooks

SPEAKERS:

Charles Banks, **R.L. Banks & Associates**
Mike Burgett, **Valero LP**
Matthew Clifton, **Holly Corporation**
Jerry Finan, **Union Pacific**
Dave Glendon, **Sprague Energy**
Gregg Haggquist, **Monterey Global Energy, Ltd.**
Stephen Jones, **Purvin & Gertz, Inc.**
Tom Landrum, **Norfolk Southern**
Lynnette leMat, **U.S. Department of Energy**
John Schlosser, **Kinder Morgan Terminals**
Joseph Shotwell, **Asphalt Operating Services, LLC**
Rockwell Smith, **Crowley Maritime Corporation**
Michael Szady, **World Energy Alternatives, LLC**
Brian Ward, **CSX Corp**
Jeff Wood, **Lehman Brothers**
Nancy Yamaguchi, **Trans-Energy Research Associates**

For a complete agenda or to register, visit our website at www.events.platts.com or call us at 866-355-2930 (toll-free in the USA) or 781-860-6100 (direct).

For more information and speaking opportunities, contact:

Mark Grady
Tel: 781-860-6115
mark_grady@platts.com

For sponsorship opportunities, contact:

Lorne Grout
Tel: 781-860-6112
lorne_grout@platts.com

For media inquiries, contact:

Christine Benners
Tel: 781-860-6104
christine_benners@platts.com

Registration Code: PC638TSM

From fries to fuel

German biodiesel producer Petrotec discusses the merits of using alternative feedstocks

German-based Petrotec is one of the leading biodiesel producers in Europe, and stands out with its ability to handle difficult-to-process raw materials. These include those with a high fatty acid content such as yellow grease, (used cooking oil) and animal fat.

Petrotec has been involved in the production of biodiesel since 2000 and is one of the pioneers of the biodiesel industry. The roots of the company go back as early as 1991 when it started as a waste management company specialising in collecting and recycling yellow grease. In 1998 the company began developing a proprietary process for the production of biodiesel. Since 2000, Petrotec has been producing biodiesel using a genuine multi-feedstock technology. This enables the company to treat an extremely wide variety of feedstocks, such as yellow grease and animal fats as well as virgin vegetable oils. Petrotec has continually increased the capacity of its biodiesel plant from 12,000 tonnes (in 2000) to 85,000 tonnes a year in 2006. By the end of 2007, the capacity will reach 185,000 tonnes.

Petrotec's founder Roger Boeing

In a short period of time a waste management business turned into a high profile biodiesel production company. The main success drivers have been the company's expertise, and its own technology, which has allowed Petrotec to produce a high quality biodiesel in compliance with the fierce European quality standard EN 14214. Petrotec is a founding member of the German Biofuel Industry Association and is a public listed company on the German Stock Exchange.

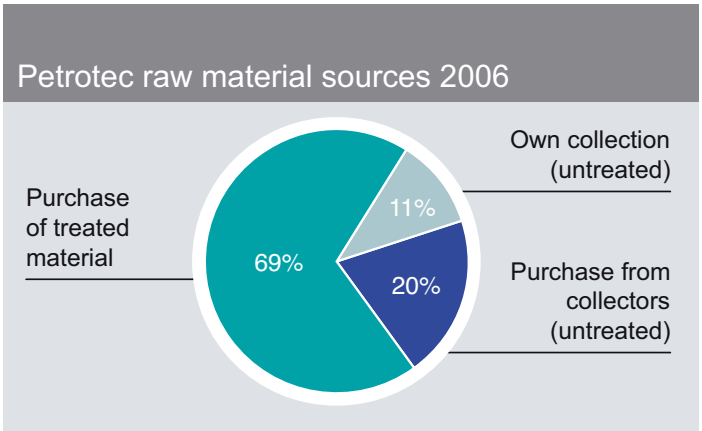
The biodiesel market in Germany has grown rapidly over the last few years. The production capacity in 2004 was 1.2 million tonnes, 2.1 million in 2005 and 4.8 million in 2006. `Due to new legislation (the biofuels quota act and the energy tax act) growth has pretty much come to a standstill now,' says company founder Roger Boeing. `The market is still split between B100 and B5 applications but with rising taxation on B100 biodiesel this market will presumably die out by the end of 2008.`

Genuine multi-feedstock technology

Petrotec's multi-feedstock technology has continually been advanced in-house since 1998. Like other biodiesel producers that operate multi-feedstock technology Petrotec is able to produce biodiesel from various pure vegetable oils including rapeseed oil, palm oil and soy oil. As opposed to many competitors, however, Petrotec is also in a position to produce biodiesel that is compliant with the European biodiesel norm EN 14214 from yellow grease and animal fats, as well as various fats and oils with a high fatty acid content. Depending on quality parameters, the feedstocks can also be blended, even though some ingredients reveal quality parameters that fail to meet the EN 14214 requirements, such as, for example, the iodine number.

In contrast to earlier years feedstock supply has become a hot issue. Petrotec is in a position to process a wide range of feedstocks, but for economic reasons the most predominant is yellow grease, which the company receives through a number of supply channels. That secures a flexible and independent demand position in the market for yellow grease. `Controlling your own sourcing makes life much easier,' explains Boeing.

The three channels Petrotec uses are:



- Its own collection network from the catering industry and countless restaurants
- The purchase of untreated yellow grease from collectors (predominantly in Germany)
- The purchase of pre-treated yellow grease though not of refined material from processors (predominantly from outside Germany)

Different from virgin vegetable oils, yellow grease does not compete with fresh vegetable oils used as food that most other biodiesel manufacturers use as feedstock.

Fully continuous production process

'One of the challenges with using alternative feedstocks is having a fully continuous technology which is capable of transferring yellow grease into high quality diesel,' says Boeing.

Petrotec's multi-feedstock process technology does exactly this. It puts the company in a position to treat the different feedstocks more efficiently than with competitor technologies. Instead of a so-called batch procedure Petrotec opts for continuous, fully automated production. The Petrotec production plant does not need to be adapted to handle different raw materials. This ensures a high degree of flexibility with regard to the raw materials purchased and used and a high level of cost-effectiveness.

In other words the input of feedstocks into the production plant, the chemical reaction and the washing, drying and distillation stages take place on an on-going basis and at the same time. Batch procedures are less efficient because at the end of every batch the next has to begin from scratch, which leads to production downtimes. The company's two-stage production process, which consists of both transesterification and acid esterification and enables up to 100% exploitation produces further advantages in terms of efficiency. Furthermore, on the back of the automated technology only two employees per shift are needed to operate the Petrotec plant. The production of biodiesel generates the by-products glycerine, fatty acids, potassium sulphate and a biodiesel polymer from the distillation stage, which Petrotec sells. It also means that there are no soap deposits or waste from bleaching and filtration.

Overall, a Petrotec plant with a production capacity of 100,000 tonnes will cost about €15 million. Petrotec's technology represents one of the lowest investment and processing costs per tonne to produce biodiesel compliant with the EN 14214 standard.

Petrotec sells its biodiesel directly to consumers such as, for example, freight forwarding companies, unblended (the B100 market) and to mineral oil dealers, who would rather sell it on unblended or blend it with mineral oil diesel (the B5 market). Petrotec has a loyal client base. In 2006, approximately 47% of biodiesel produced was sold in an unblended form (B100) directly to freight forwarding companies, and the remaining 53% to mineral oil dealers.

Quality is a key success factor

At Petrotec's biodiesel plant the company maintains its own laboratory, in which the quality of the biodiesel produced is constantly monitored with regard to fundamental EN 14214 quality parameters. In Europe the EN 14214 has 26 test criteria. It is a standard which is accepted by both mineral oil companies and car manufacturers. Furthermore, quality controls are conducted regularly by external institutes. Petrotec procures its feedstocks from selected suppliers, who provide proof of origin and certificates. In addition, before any goods are accepted, a sample is taken and examined. `Quality is critical to customers because authorities will only grant subsidies or tax exemptions when biodiesel is in compliance with the norm,' explains Boeing.

International expansion ahead

On the back of its strong position in Germany with a production capacity of 85,000 tonnes a year, Petrotec is busy building a 100,000 tonne capacity biodiesel plant complete with dedicated tank farm in the sea port of Emden in the North Sea, which will then function as an export and import hub. In this way, the group will be able to achieve significant purchasing

economies of scale and more favourable logistics costs. The existing facility will likewise benefit from this cost optimisation. Emden is the launchpad for the swift and cost effective sea-based export of biodiesel to other EU member states and to the international trading centres of Rotterdam and Antwerp.

Petrotec's further expansion will focus on the appeal of the markets identified in the UK and the US. Its criteria include:

- Sales potential above all in conurbations (urban regions)
- Feedstock availability and in-group collection feasibility or via alliances
- Logistical connections to the domestic transport infrastructure with the focus on sea ports for shipping feedstock and biodiesel
- A regulatory framework such as the expected RTFO decree on additive quotas in the UK and US subsidies to promote biodiesel

Petrotec also sees Asia as a attractive market both in terms of feedstocks and biodiesel distribution. `Much of Asian food is fried so there is plenty of yellow grease available,' says Boeing. `The emerging countries in Asia are looking for alternative energy sources so homemade biodiesel will serve their needs and make them less dependent on the foreign oil market.'

Not only bio but sustainable

Producing biodiesel from yellow grease is almost carbon dioxide neutral as it entails a closed recycling process, and thus offers the highest energetic benefit and maximum eco-friendliness in line with the EN 14214 standard. This optimised sustainable cycle is marginally constrained by the fact that in the winter and transition period (October 1 through April 15) rapeseed methyl ester has to be added to keep yellow-grease-based biodiesel fully fluid.

Given the ambitious self-imposed climate-change objectives the EU member states have adopted as regards specifically carbon dioxide emissions and the current refocusing of US energy policy, Petrotec believes it is superbly positioned to penetrate and lock into existing and newly emerging markets for the production and distribution of biodiesel. Petrotec's expansion and the new network will create clear axis for a green global market in which biodiesel emerges as an internationally fungible fuel. ●

International Congress on Biodiesel: The Science and The Technologies

5–7 November 2007

Hilton Vienna • Vienna, Austria

Join the global discussion on the science of biodiesel.

www.aocs.org/meetings/biodiesel

8th AOCS Practical Short Course on Biodiesel: Processing, Chemistry, and Production

4–5 November 2007 • Hilton Vienna

(preceding the International Congress on Biodiesel)

BIOFUELS 2007

29-31 OCTOBER 2007
MARRIOTT HOTEL
VIENNA, AUSTRIA

EVENT SPONSORED BY

VOGELBUSCH

innospec fuel specialties

Lurgi

KEY SPEAKERS

Suren Ajjarapu
President
AE BIOFUELS INC

Artur Thernesz
Director, Downstream Technology & Development
MOL

Analía Acosta Lorenzo
Biofuels Manager
REPSOL YPF ABB

Jan Brentebraten
Marketing Director
FORD EUROPE

Sillas Oliva Filho
Marketing Manager, Ethanol & Oxygenates
PETROBRAS

Ludwig Dinkloh
Head of International Business
SCHMACK BIOGAS

Sun Shuzhen
Managing Director
JILIN FUEL ALCOHOL COMPANY LTD

Bernard Nicol
CEO
DIESTER INDUSTRIE

Philippe Gall
Global Crop Manager, Oilseeds
SYNGENTA

Unnikrishnan Ramachandran Unnithan
Executive Director
CAROTINO SDN BHD

Claus Sauter
Chief Executive Officer
VERBIO

Lutz Guderjahn
Member of the Executive Board
CROPENERGIES AG

EVENT ORGANISED BY THE WORLD REFINING ASSOCIATION
FOR FURTHER INFORMATION PLEASE CONTACT:
Chris Taylor, Conference Manager
Tel: +44 (0)20 7067 1800 Fax: +44 (0)20 7430 0552
Email: c.taylor@theenergyexchange.co.uk
Or visit our website: www.wraconferences.com

Biofuels International magazine has joined forces with Biodiesel Expo to highlight key exhibitors at the event on 17 and 18 October in Nottinghamshire, UK

Biodiesel Expo 2007

Advanced Biofuel Solutions and Hydro Dynamics have teamed up to offer the biodiesel industry a next generation biodiesel reactor – the Shockwave power reactor.

With an elegantly robust design, the Shockwave power reactor drives the transesterification reaction toward completion in seconds and provides the ability to achieve total glyceride levels of less than 0.05% in the final biodiesel product.

With its small footprint, the shockwave power reactor provides great flexibility and efficiency in batch, continuous and semi-continuous biodiesel production systems.

Reactor systems are available with capacities ranging from 1,000 m^3 to 550,000+ m^3 a year.

Visit at stand # 15

Ageratec is a medium-sized biodiesel company with 56 plants operational in 15 different countries with capacities from 600 tonnes to 30,000 tonnes. The company has 26 plants in construction with capacities of up to 100,000 tonnes.

Visit at stand # 2

AirProtekt operates in partnership with Johnson Matthey as the sole distributor for industrial air pollution control catalysts. Worldwide, a total of more than 1,000 catalytic oxidation systems have been installed using AirProtekt catalyst technology.

AirProtekt is also the sole UK distributor of regenerative thermal oxidisers (RTOs) for Lufttechnik Bayreuth Ruskamp, which has installed more than 50 RTOs across Europe.

AirProtekt offers the following:

- Catalytic oxidation systems
- RTOs
- NOx abatement systems
- Exhaust catalysts for stationary engines and turbines

For diesel, biodiesel and gas engines, AirProtekt offers carbon monoxide and hydrocarbon oxidation catalysts, threeway non-selective catalytic reduction catalysts, complete (urea injection system) turn key equipment and combined catalysts and silencers to achieve a specific noise reduction level.

Visit at stand # 82

Alvan Blanch is a UK manufacturing and project engineering company with a global outlook, specialising in the design, production and supply of quality machines and completely integrated systems for the primary and secondary processing of agricultural produce and waste materials.

It has developed its oil expeller press specifically to match the requirements of small-scale biodiesel producers in Europe, paying particular attention to the need for automation, efficiency and reliability at an affordable price.

Its XP100 expeller press will process up to 3.5 tonnes of rapeseed in a 24-hour day, yielding approximately 1,000 litres of oil.

Alvan Blanch also offers systems for processing the oil cake into pellets.

The company's machines are backed by a comprehensive technical support package, from an initial site visit, to system design, commissioning, training and after-sales/service back-up from regionally-based engineers.

Visit at stand # 52

Analytik supplies unique and innovative analytical solutions for material characterisation. This includes the Analytical Spectral Devices (ASD) range of rugged and completely portable spectroscopy instrumentation.

From characterisation of oil content of soybeans and other crops, to quantification of key parameters in biofuel processing and quality analysis of final product, the use of near-infrared (NIR) spectroscopy is rapidly increasing throughout the biofuels industry.

The escalating use of NIR is directly attributable to the technique's convenience and ease of use. Typically NIR can reliably and accurately quantify levels of key parameters in raw fuel material including moisture, glycerin, fatty acid ethyl esters (FAEEs) and fatty acid methyl esters (FAMEs).

ASD systems exhibit extreme performance characteristics whatever the conditions. The instruments rapidly provide research grade data where and when it is needed.

Visit at stand # 77

Anchor Pumps is a specialist pump supplier. It is a major distributor and stockist for:

- VIKING – gear and vane pumps
- BLAGDON – air operated diaphragm pumps
- GRUNDFOS – centrifugal pumps

The company supplies and services pumps of all types as well as offering on-site installation.

Of particular interest to biodiesel manufacturing, Anchor Pumps offers:

- Pumps with excellent abilities to handle low vacuum suction conditions
- Pumps for high temperature duties
- Pumps for variable flow rate applications
- Pumps with ATEX certification

Visit at stand # 39

Anton Paar is celebrating 25 years of achievement in the UK in 2007, selling and supporting the Anton Paar range of instruments. This year also marks the 40th

anniversary of the development of the vibrating U-tube, which is now the automatic choice for precision density measurement across many industry sectors.

Its laboratory range includes the DMA 35n handheld density meter ideal for smaller establishments and throughout the production and supply chain of larger facilities.

The company also has a DMA 4100 density meter, a laboratory instrument that meets the requirements of EN12414 for biodiesel and EN12185 for petroleum products.

For the laboratory it has the RXA range of refractive Index instruments for testing fuels to ASTM 1218 and for monitoring glycerine purity up to pharmaceutical grades.

The Anton Paar process instrument range covers all sizes of production facilities with instruments such as the L-Dens 313 and DPRn range. Applications include phase detection and final product monitoring.

Visit at stand # 14

ASG is the first European laboratory with an ISO 17025 accreditation for biofuels. It specialises in answering all analytical and technical questions around biodiesel, bioethanol and vegetable oil fuels. Its analytical service comprises testing of all parameters according to national and international specifications including EN 14214, ASTM D 6751 and DIN 51605.

ASG has a new customer centre for biodiesel process development, allowing customers to work with the optimum procedures enabled with the mini-plant laboratory.

This includes:

- Oil pressing and extraction under laboratory conditions
- Transesterification experiments (batch or continuous operation)
- Simulation of washing, drying or distillation processes
- Reaction optimisation

Visit at stand # 97

Aspectrics manufactures at-line and on-line process analysers for gas, liquid and solids applications. Aspectrics' new 2750 biodiesel analyser is targeted at the biodiesel quality control process market. The analyser is a compact and easy to use biodiesel QC package capable of at-line and on-line analysis of biodiesel samples.

It can measure incoming feedstock quality, in process samples, finished product quality (B100), glycerin and recycled methanol. The Aspectrics QC Package includes the Aspectrics RealTime Monitor software. The Aspectrics RealTime Monitor interface displays sample concentration values in real time, plots the results in an SPC format and allows the user to set out of range warnings.

Visit at stand # 84

Atkinson Equipment has manufactured products for fuel oil storage tanks for over 40 years. The Atkinson family firm has the advantage of a fully equipped engineering workshop with the latest CNC machines, together with welding and fabrication facilities, assembly and pump build production lines.

Atkinson Equipment has built a reputation for quality equipment designed and manufactured in Wiltshire, UK. Sight gauges and trigger nozzles became synonymous with the name Atkinson and the Atkinson Tankmaster has been the heating industries standard for many years.

Great Plains Industries appointed Atkinson Equipment UK distributor in 1995 for its fuel pumps, meters and industrial inline turbine meters. To widen the range further Atkinson also offers a number of pump types and makes including the PIUSI range of refuelling equipment.

Visit at stand # 4

AxFlow is a pump specialist with 14 engineers located throughout the UK, and bases in London and Aberdeen with a total of 44 employees.

AxFlow is part of the pan-European AxFlow Group which employs 385 staff in 17 operating companies serving the fluid handling requirements of all industries. Whether it is a pump-in-a-box or a complex custom-built system, AxFlow's specialist engineers provide a complete product and service package with total responsibility from initial concept through to installation and commissioning. The company provides service and repair either on-site or as factory return units.

Visit at stand # 24

BioDiesel International (BDI) is one of the world's leading suppliers of complete biodiesel production plants. The services the company provides include plant planning, construction and start-up and after-sales service. BDI has had in-depth experience with the production of biodiesel and owns an extensive patent portfolio that has resulted from its in-house R&D activities.

The company considers itself to be among the leading international technology suppliers on the market for the production of multifeedstock plants that can manufacture biodiesel on the basis of different raw materials, such as vegetable oils, waste edible oils and animal fats.

Visit at stand # 89

BHR Biofuels is a new breed of biofuels company drawing on over 100 years of chemical process design. It has expertise in mixing systems and process intensification methodologies. BHR Biofuels has taken the biodiesel manufacturing process and designed systems to perform the biodiesel reaction in highly optimised, efficient ways, avoiding the pitfalls that many other manufacturing systems fall into.

Systems from 20 to 200 MT/day and more are available.

Visit at stand # 53

BioDiesel Technologies is a biodiesel equipment manufacturer and project developer based in Austria. The company was founded in 2003 and has 17 multi-feedstock projects operating in 10 countries worldwide. BDT's success is build on its standardised modular processing units, the CPU 1000 and CPU S-07, which have starting capacities of 8,000 tonnes a year and 30,000 tonnes a year. Principal benefits of BDT's equipment include: modular, containerised, certified, serial production, fast delivery times, plug and play start-up and easy expansion.

Visit at stand # 67

Bioking is a dynamic and leading manufacturer of a complete range of biodiesel equipment located in the Netherlands. Hans and Marco van de Ven, the owners of the company, have more than 20 years experience in manufacturing, chemical mixing, handling equipment and automated batch process systems, and aim to bring biofuels into the mainstream market.

The company is primarily involved in the supply of biodiesel process equipment and biodiesel supplies, and it

provides biodiesel processors from compact units to full-scale industrial plants.

Bioking is proud to supply the best products available on the market today at the best prices. It offers biodiesel solutions for individuals, companies, farmers and commercial producers worldwide, with capacities ranging from 300 litres a day to 100 tonnes a day.

Bioking is now an official distributor for Algae Link.

Visit at stand # 43

Bio UK Fuels is a successful business, providing a unique top-to-tail recycling waste into energy franchise, specifically designed to meet the growing demand for renewable energy, managed waste solutions and reductions in carbon emissions throughout the UK.

Recycled biodiesel from waste oil can power any diesel engine. Bio UK Fuels' unique franchise model powers vehicles with used cooking oil from local food suppliers. This creates a closed-loop recycling business.

Visit at stand # 75

Centrifuge Experts International specialises in all types of centrifuges, centrifuge repair, selection of new or used centrifuges and machinery and system design.

Visit at stand # 27

CDR Pumps has been manufacturing pumps for the safe handling of chemicals and solvents for over 40 years, produced from materials including polypropylene, ETFE, PFA lining, stainless steel and exotic alloys.

CDR Pumps is serving the biodiesel market with pump technology that includes the safe handling of caustic solutions. The company also handles solvents and liquids at high temperatures, carrying fully compliant ATEX certification. Its technology is being used extensively in the installation of new biodiesel plants throughout Europe.

Visit at stand # 63

Dallas Group, a manufacturer of Magnesol D-Sol is the recognised leader in oleo-chemical purification technology. The Magnesol Dry-Wash method ensures biodiesel quality that meets specifications. Magnesol Dry-Wash adsorbents are used in place of a water wash and significantly reduce contaminants while increasing oxidative stability.

Visit at stand # 80

Debem is a specialist in the production of air operated diaphragm pumps used in all main industrial sectors. Its range includes Boxer and Cubic pumps equipped with special pneumatic exchangers.

The models are available in polypropylene, ECTFE, aluminium and stainless steel AISI 316.

Debem air operated diaphragm pumps have the ATEX certification and can be used in explosion risk environments. The company also manufactures pneumatic pulsation dampeners, centrifugal pumps and drum pumps.

Debem is ISO 9001: 2000 certified and in the UK JMAGIC Pumps is the authorised distributor for all of Debem's pumps and accessories.

Visit at stand # 103

Elaflex produces and supplies ZVA range of dispensing nozzles and hoses. Also available are hose reel kits, diaphragm pumps, air operated pumps and drainers.

Visit at stand # 71

EP Minerals is a worldwide manufacturer and supplier of diatomaceous earth (DE), perlite and cellulose fibre. Entering the DE market in 1945, EP Minerals has since become the fastest growing producer of DE products and the second largest producer in the world.

To this day, EP Minerals continues to deliver the highest quality filter aids, high capacity absorbents, and functional additives for paints, catalyst supports, polyethylene film and many other markets.

Visit at stand # 88

Eurotank offers biodiesel quality management services for downstream retail and commercial storage systems. It is the exclusive operator of a Zone 0 endoscope system, which was developed in Scandinavia to guarantee the removal of water from E5 storage tanks.

The introduction of biodiesel into Scandinavia highlighted the major problems caused by moisture within storage systems, which has a negative effect on biodiesel quality.

Accelerated degradation of biodiesel blends, microbial contamination and filter blockages are all directly caused by moisture within underground fuel storage systems.

Free water and suspended moisture must be removed as often as possible to ensure trouble free operation. Eurotank provides water removal, fuel polishing, tank cleaning and pump filter cleaning services to the two largest biofuel retailers in the UK. It also designs and develops specialist equipment and software to provide retailers and operators with best practice in this sector.

Visit at stand # 48

Filtertechnik offers:

- Waste vegetable oil filtration
- Rapeseed oil filtration
- Water removal processes
- Dry washing with Magnesol
- Final polishing methods
- Flow measurement solutions
- On-line particle counting
- Moisture level sensors

Filtertechnik can assist customers in finding the most cost-effective filtration and clean-up solutions to ensure the highest quality of biodiesel production.

The company specialises in dry wash filtration solutions for small and medium sized batch production systems through to large scale continuous production systems.

Visit at stand # 35 & 36

FM Environmental incorporates a group of business operations, which provides specialist services to the pump and wastewater treatment industry. Based at its head office in Newry, Northern Ireland, with regional offices in Malaysia and Malta, the group offers a comprehensive range of design, manufacturing, contracting and installation services. FM has been supplying its Grease Guardian automatic grease removal systems for more than 15 years to over 40 countries.

This internally mounted grease interceptor is installed in the kitchens of hotels and restaurants, deli/hotfood bars, schools and other community facilities. Grease interceptors can be specified by environmental health officers for facilities with the potential to cause grease and fat contamination of sewers, treatment plants and pumping stations. As good practice it is

highly recommended that a system be factored into development and refurbishment costs in advance.

Visit at stand # 16

Fort Vale will be displaying its third generation 4" Safeload bottom loading coupler. New to the market in January 2007, the Mk3 is an evolution of Fort Vale's Mk2 well-known coupler with the distinctive red PU ring.

The red ring has gone but the unique feature of the new model is the profile of the wrap-around triggers, the curve of which matches the form of the adaptor. This significantly reduces wear to both components and offers maximum security of connection. The bonus of this is less down-time, easy maintenance and therefore lower costs.

The Safeload coupler has undergone a programme of continuous development over the past 10 years and has been used on 100% biodiesel for at least three years.

Since its launch, Fort Vale has gone on to develop a low profile release handle version, which was designed to offer sufficient clearance to meet particular European customer needs. This has the added benefit of allowing the coupler to be mounted in a 90° orientation and can be seen at the show.

One of the refinements of the Safeload coupler range is to include various seal options; most significantly a GFLT-S seal that has excellent performance in oxygenated automotive fuels.

The standard Mk3 Safeload is suitable for use with both biodiesel and bioethanol. Fort Vale has recognised the importance of seal compatibility and offers a fuel testing service to check swell values of customer samples.

As a UK manufacturer, with depots around the world, Fort Vale offers a comprehensive package of expertise. As the celebration of its fortieth year in business draws to a close, it seems appropriate to be on stand 40.

Visit at stand # 40

FOSS produces and supports dedicated analytical solutions for the biofuel industry, using patented techniques and approved methods.

It has a proven track-record in grain quality analysis that is unique to the industry, and is the only supplier to offer a complete range of rapid analytical systems with indirect and reference methods. Solutions are based on near-infrared transmittance and reflectance techniques, wet chemistry or digital image analysis. Typical parameters are protein content, starch, moisture, fat and fibre.

FOSS can provide a total solution for analysis and quality control of agricultural products throughout the production chain, from on-line process quality control to routine analysis in the reference laboratory.

Visit at stand # 44

Future Fuels was founded in November 2005, and started out simply to make biodiesel. After looking at the equipment available at that time, the company could not find a system that suited its requirements so decided to design its own.

The first system, the FF1000, set new standards proving the possibility to take used vegetable oil and convert a waste product to high quality biodiesel. The company worked on a list of ideal standards which also incorporated a two hour reaction cycle.

Its systems feature stainless steel reaction vessels and ATEX approved components including pumps. Future Fuels also fits internal explosion-proof heaters and all the fittings either stainless steel or galvanised.

The range of systems have expanded from its FF150 (150 litre processor) to the FF2000 (2000 litre processor).

Future Fuels designs, manufacture and installs complete biodiesel processing plants capable of producing up to 14 million litres a year. The company offers a full range of processing equipment, supplies and solutions. These include pre-treatment, various wash and filtration products, biodiesel and vegetable oil supplies and consultancy services.

Visit at stand # 72 & 73

Grace Davison is a core business of WR Grace & Co., one of the world's leading speciality chemical companies, specialising in silica and silica amumina technology. It produces a wide variety of products based on silica gels, zeolites, colloidal and precipitated silicas.

Its broad material portfolio has contributed to Grace Davison's position as a leading supplier of silica and zeolitic adsorbents supplied by the Engineered Materials business unit.

The silica gels are used, among other applications, as purification aids in edible oils where they help to remove phospholipids, trace metals and free fatty acids in addition to aiding moisture removal. The zeolitic and silica adsorbents are used for drying and purification of industrial and natural gases where, by controlling pore size of the material, the company can preferentially remove undesirable components.

Visit at stand # 31

Green Fuels was formed to bring affordable and sustainable biodiesel technology to the UK and European marketplace. Its products range from as little as producing 45,000 litres a year, to as much as 30,000,000 litres a year.

All of its products incorporate the latest techniques in biodiesel production and are operational throughout the world.

Visit at stand # 49 & 50

Hartridge tests diesel injectors and pumps, from traditional to common rail and electronic unit injectors.

Its equipment can determine the effects of running biodiesel and evaluate the condition of fuel injection components to discover if they need replacement or repair. This saves time and money by managing the maintenance of vehicles and only changing expensive parts that actually need replacing.

Hartridge provides a range of equipment from simple evaluation tools to full diagnostic benches that are used worldwide by authorised and independent diesel specialists for diagnosing and repairing diesel fuel injection systems.

The company is the approved supplier to the major diesel equipment manufacturers including Caterpillar, Cummins, Delphi, Denso, Siemens, and Stanadyne and also provides equipment for testing Bosch diesel fuel injection systems.

Visit at stand # 98

Hytek, a fuelling equipment provider, will be displaying IBC pump kits which offer a complete dispensing solution, the all new tank cleaner – ideal when changing mineral diesel tanks over to biodiesel – and a version of the heavy duty Alpha pump, suitable for use with pure biodiesel.

Also on show will be a range of specialist water and particle filters, spill kits, tank alarms and gauges and 230V transfer pumps for use with clean oils up to SAE90 and B100 biodiesel.

The specialist Hytek range is only suitable for biodiesel that has been refined to meet the European standard EN14214.

Visit at stand # 76

Intertek Caleb Brett operates a network of state-of-the-art analytical testing laboratories across the world. Intertek laboratories engage in research, testing and measurement activities for industry, commerce, markets, institutions and government.

A wide range of industries benefit from Intertek laboratory services including petroleum, chemical, energy, electronic, pharmaceutical, food, biotechnology and many others. Petroleum testing and inspection are provided for the entire hydrocarbon product range: crude oil, refined fuel oil, residual oil, residual, LPG, LNG, petrochemicals, industrial gases, natural gas and biofuels.

Intertek labs follow ASTM, IP and other recognised petroleum test methods and regulatory protocols. Intertek is a world leader in providing petroleum testing, sampling and inspection services to oil and chemical companies on a global basis.

Quality specifications for European biodiesel fuel blend stock for distillate fuels can be confirmed by laboratory testing. Intertek biodiesel lab testing conforms to EU biodiesel fuel standard EN-14214.

Visit at stand # 64

Lanxess is a reliable, proven and respected expert in the field of chemistry. With sales of approximately €6.94 billion in fiscal year 2006 and 16,481 employees Lanxess is a leading supplier of chemicals to customers around the world.

The business activities of the Lanxess Group, headquartered in Leverkusen, Germany, are performed by a total of 14 operating business units that make up the performance rubber, engineering plastics, chemical intermediates and performance chemicals segments.

The product portfolio also includes the biodiesel stabiliser, Baynox. This effective antioxidant produces good results in biodiesel produced from rapeseed oil, waste cooking oils, animal fat and palm oil.

Visit at stand # 101

Law-Denis Engineering manufactures grain and oilseed storage equipment, including dryers, cleaners, conveyors, elevators, silos and silo dischargers.

It designs and installs plants for all types of cereals and oilseeds both in the UK and worldwide. Working closely with the German company Reinartz, manufacturers of oilseed presses and filters, it can offer the complete turnkey oilseed extraction plant with capacities from 40 kilograms an hour up to 2000 kilograms an hour.

Visit at stand # 60

Master Farm Services, in conjunction with Kent Bio Fuel, provides a cost-effective and efficient option for dealing with cold seed pressing for the extraction of oil from many seed-based products. Capacities range from 50-400 kilograms an hour with extraction takes of over 30%.

The Master range of Kent Bio Fuel generators make the production of biodiesel a realistic alternative to conventional diesel fuels. Systems are designed to meet individual capacity requirements and incorporate all the equipment necessary to ensure that the end result is a high quality fuel.

Full start-up production training facilities on site are available on new installations.

Visit at stand # 33

Merebrook is a multidisciplinary consultancy practice with experience of application for and negotiation of various environmental permits including PPC permits.

It is a requirement for all commercial biodiesel production projects that the producer obtains and maintains a PPC permit. This enables the Environment Agency to ensure the production activity is adequately controlled and does not lead to significant additional environmental impacts.

Merebrook can deal with the full assessment and application process or work with clients to ensure that their application procedure is compliant. For non-controversial applications it is often possible to make an application without physical investigation of the site. However if there is a potential for the site to be historically contaminated then it can be prudent to undertake baseline ground contamination surveys.

Visit at stand # 95

Metrohm has developed the 743 Rancimat, which allows simultaneous and rapid oil stability indexes (OSI) to be performed.

Typical applications include:

- Oxidation stability of oils and fats

- Oxidation stability of vegetable and motor oils
- Oxidation stability of biodiesel
- Determining the effectiveness of anti-oxidants

Visit at stand # 65

Mettler Toledo provides test equipment for numerous standard test methods including KF titration, acid number, iodine value, density and refractive index determinations. Laboratory, plant-based or portable instruments are available to suit all needs.

Biodiesel is made by the chemical process of transesterification, which separates glycerin from fat or vegetable oils. The Metrohm Rancimat is the method used for measuring the oxidative stability of fatty acid methyl esters.

All oils and fats have a resistance to oxidation that depends on the degree of saturation, natural or added antioxidants, prooxidants or prior abuse. Oxidation is slow until the resistance is overcome, at which point oxidation accelerates and becomes very rapid.

The length of time before this rapid acceleration is the measure of resistance to oxidation and is commonly referred to as the induction period. The new official method for determining the induction period, or oils stability (OS) as it is more commonly known, determines OS in rapid and automated fashion (AOCS official method CD 12-92, AOCS Cd-12b-92, JOCS 2.4 28.2-93, SLB Section 7.5.4)

Visit at stand # 45

Michael Smith Engineers was formed in 1971 as a specialist pump distributor. It has been ISO 9000 accredited since 1994. The main markets it services with its range of pumps are the chemical, petrochemical, pharmaceutical and process sectors.

The company specialises in seal-less products and offers ranges of magnetically driven gear and centrifugal pumps (including metal, plastic and lined centrifugals), canned motor centrifugal pumps, peristaltic pumps, metering pumps, valveless piston pumps, progressive cavity pumps, high pressure diaphragm pumps, vane pumps, lobe pumps and barrel emptying pumps.

It can supply pumps, both sealed and seal-less, in a wide choice of wetted materials for liquids between 0.2 cP and 500,000 cP, temperatures between -50° C and 450°C. Capacities range from nanolitres a minute to m^3 a minute and can offer pumps for discharge pressures up to 500 bar.

Visit at stand # 3

MSE Hiller specialises in the supply and rental of centrifuges for solid/liquid separation and three phase liquid/liquid/solid separation.

Both disc stack and decanter type centrifuges are supplied to the biodiesel and vegetable oils processing markets and capacities range from 500 to over 100,000 litres an hour.

These high performance centrifuges are fully enclosed, compact, fully automated and offer high recovery rates at low running costs.

All necessary ancillary equipment such as tanks, pumps, pipework, conveyors, flowmeters, support stands and control panels may be provided as a tunkey installation.

Explosionproof, gas tight and three phase designs are available that conform to all current ATEX regulations.

Visit at stand # 11

OPW Fluid Transfer Group (OPWFTG), part of the Dover Corporation, is comprised of six market-leading operating companies, each dedicated to designing, manufacturing and distributing world class solutions that assist in safe handling and transporting of hazardous bulk products. In addition to these companies, OPWFTG has operations in the US, Europe and Asia.

OPWFTG's main activities are:

- Petroleum trailer products, dry-bulk rail/highway trailer products
- Loading arms, quick and dry disconnects couplers
- Industrial valves, dry-bulk material handling systems

Visit at stand # 17

Parker Hannifin's filtration group manufactures a comprehensive range of filtration and monitoring equipment that is proven in automotive, production and powergen industries.

The range includes Parker Condition monitoring and Parker Racor fuel filtration products.

Parker Filtration technology can help engine manufacturers and end-users overcome the challenges of biofuels and extend engine reliability and operating life.

Parker Hannifin's Racor division has developed an innovative range of products that provide filtration ratings down to 2μm. Based on its widely used Spin-On filter series, the 400 Series HH filter assembly has been designed specifically for use with modern, eco-friendly fuels including low sulphur and biodiesels.

This particular filter comes in three sizes, based on maximum fuel flows of 250, 350 and 600 litres/hour respectively, but all are equipped with a 10μm rated filter element, a high capacity see-through water collection bowl and a built-in primer pump.

As a result, the filter can cope with the typical levels of contamination that might be expected in a biodiesel and is also equipped to tackle the potential problems of operating in low ambient temperature conditions.

Visit at stand # 19

PerkinElmer is the only supplier offering solutions for every analytical measurement required by biodiesel producers including: raw material assessment, control of production processes and meeting the regulatory requirements of DIN, EN and ASTM.

Visit at stand # 86

Protectoseal is a leading manufacturer of low pressure tank venting equipment, flame and detonation arresters, tank blanketing valves, and speciality tank fittings.

Established in Chicago in 1925, Protectoseal has extensive experience of supplying equipment for atmospheric and low pressure storage tanks and is the leading supplier in the US biofuels market.

Allowing tanks to breathe while conserving the stored liquid is the essence of Protectoseal's range of Conservation Breather vents, which boast the lowest leakage rate in the industry. Tanks equipped with Pipe-away vents and the ingenious PinTech Emergency vents can keep emissions below 500ppm.

Protectoseal prides itself on the reliability of delivery times, and its level of technical support offered by its network of representatives. Protectoseal is represented in the UK by Flexachem UK.

Visit at stand # 87

Biofuel Easy Street.

Partner with PerkinElmer. Ensure ASTM and EU Compliance. Optimize Quality.

Get your biofuel plant up and running smoothly without costly roadblocks and detours. PerkinElmer offers the broadest range of best-in-class analytical instruments, comprehensive Laboratory Information Management Systems (LIMS) and superior service and support to keep you in the fast lane. Our extensive knowledge and expertise in biofuels can help you maintain compliance with ASTM and EU standards. **Meet the biofuel analytical instrument experts.**

Visit www.perkinelmer.com/biofuel
to view one of our archived online seminars.

Call +1(203) 925-4602
to speak to a biofuel specialist.

Gas Chromatography • FT-IR Spectroscopy • ICP-OES • LIMS • Liquid Scintillation

PerkinElmer®
precisely.

www.perkinelmer.com

The Sartec Group supplies a wide range of diesel and fuel oil analysers to the petrochemical industry. They are used extensively for laboratory fuel testing and mobile laboratory field inspection. Analysers on show will include:

- Cloud and pour point
- Cold filter plugging point
- Chlorine content
- Check fuel blending
- Distillation
- Dye content
- Flash point
- Sulphur content
- Vapour pressure
- Viscosity

The latest IROX diesel analyser from Grabner Instruments, which provides details for the key properties of diesel fuel, will also be on display.

Visit at stand # 83

Schoeller Arca Systems is introducing the Combo range of products. Operating in over 50 countries, Schoeller Arca Systems provides reliable, high quality plastic packaging systems and services.

The Combo concept is the result of a development project in cooperation with global food and beverage companies which handle large volumes of liquid products. The concept is based on large foldable containers with flexible liner bags.

The result is a packaging system that reduces the packaging costs compared to traditional alternatives, simplifies handling throughout the logistics process, provides safe transportation and storage of liquid products and is returnable, reusable and totally recyclable.

Visit at stand # 34

SGS is a global leader in the field of verification, inspection, flow measurement, testing and certification.

Biofuels technology is a key business within SGS' network of almost 1200 offices and laboratories around the world. SGS is committed to the delivery of enhanced value to its clients. The company has a number of UKAS accreditation laboratories, located throughout the UK, combined with full cargo inspection capabilities.

Visit at stand # 38

Shimadzu offers instruments for analysis and measurement in industry and research, environmental testing and other bio-related equipment software services.

Visit at stand # 69

Simon Storage's bulk liquid and gas network delivers a supply chain management service that covers every aspect of storage, handling and distribution by road, rail, sea and pipeline of a wide range of chemicals, petroleum products, gases and pharmaceutical and edible products.

Simon Storage owns and operates tank terminals, tank trucks and containers, railheads and pipelines, managing the movement of bulk liquids and gases throughout Europe. Its also provides expertise and capabilities in technical facilities management, engineering, project management, planned maintenance, training, automation systems and stock management.

Visit at stand # 41

Stanhope-Seta is a UK company specialising in the design and manufacture of quality control test equipment for biofuels and petroleum products in accordance with national and international specifications, such as EN14214, EN590 and EN228. Equipment strictly conforms with EN, IP, ISO, ASTM and CEN methods.

A broad range of instruments includes cost-effective test solutions for flash point, viscosity, corrosion, cloud point, filter blocking tendency, particle counting, ash, oxidation, and carbon residue.

The company is also the European partner for Advanced Engine Technology, Canada, the manufacturer of an ignition quality tester for fast and simple measurement of derived cetane number. Equipment conforms to the new standards pr-EN15195, IP 498 and ASTM D6890.

Visit at stand # 68

Thermo Fisher Scientific is a leader in serving science. The new Thermo Scientific brand represents a union of two market leaders in scientific discovery: Thermo Electron and Fisher Scientific.

A strong focus on R&D means the Thermo Scientific brand continually provides novel tools to advance and support customers' efforts.

Visit at stand # 94

Timeplan is one of the leading fuel management facilities companies, providing products and services in order to dispense and monitor fuel and associated products securely, accurately and efficiently to both the public and private sectors. The company has been supplying the transport sector for 30 years with cost effective, reliable and innovative products and solutions.

Timeplan offers a comprehensive range of high quality products and services for businesses of any size in the following categories:

- Fuel management systems
- Fuel pumps
- Fuel tanks
- Tank gauges and stock monitoring systems
- Installation and maintenance services
- Management reporting and back office support

Visit at stand # 46

Titan Environmental is the clear market leader in oil, fuel and lubricant storage. Reliable, innovative and safe, Titan's range of tanks and containers provide one of the best options for every situation whether domestic, commercial or agricultural.

Specially designed biodiesel storage systems are now available from the new TITANbio range. The Titan BioMaster30 is designed for biodiesel blends of up to 30% and ensures biofuels are stored correctly and safely. The Titan BioMaster30, with its totally enclosed bunded tank and integral pump and nozzle, is an ideal solution for those who need readily available biofuel in a variety of locations.

Visit at stand # 29

Tuffa UK is a storage tank manufacturer for biodiesel storage requirements. It is a specialist in biodiesel tanks and dispensing equipment, mixing systems and bunded storage.

The company manufactures a range of tanks for all types of liquid storage from 1,300 - 100,000 litres including Derv, oils, water, chemicals and waste water.

A full range of tanks are available including bunded tanks, fuel stations, petrol tanks, site bowsers, waste oil tanks and fireproof tanks.

Visit at stand # 58 & 59

Biofuels Conference

17–18 October 2007

Newark Showground, Nottinghamshire, England

The largest biofuels event in Europe this year

The Biofuels Conference will be held alongside the Biodiesel-Expo which will feature over 100 trade stands and 4,000 visitors.

Can you afford not to be there?

Key subjects	Key speakers
RTFO	HM Treasury
Sustainability	Department for Transport
2nd & 3rd generation fuels	Environment Agency
Food vs fuel	BP Biofuels
Biofuel profitability	Virgin Trains
Meeting quality standards	Deloitte
Global market forecasts to 2020	D1 Oils
	United Oilseeds

Book now and receive a FREE copy of the *Biofuels Industry Directory!*

Whether you are in the biofuels market or you want to learn more about the issues surrounding biofuels this is the *must attend* event of the year!

Book online at www.biofuelsmedia.com or call +44 (0)208 846 3792

Supported by:

What Diesel Car?

biofuels international

Deloitte.

Asia Biofuels Conference & Expo V

FILTERTECHNIK

Addressing The Strategic Challenges Of Successfully Bringing Biofuels To Full Commercialization

the CWC alternative energy series

FUTURE FUELS

December 3-5 2007 • Marriott Hotel • Washington D.C.

KEY SPEAKERS INCLUDE:

- **Daniel S. Sullivan,** Assistant Secretary of State for Economics, Energy and Business, U.S. DEPARTMENT OF STATE
- **Jacques Beaudry-Losique,** Biomass Program Manager, U.S. DEPARTMENT OF ENERGY
- **John Berger,** CEO & Chairman, STANDARD RENEWABLE ENERGY and Chairman, BIOSELECT FUELS
- **Joseph Jobe,** CEO, NATIONAL BIODIESEL BOARD
- **Brian Appel,** CEO, CHANGING WORLD TECHNOLOGIES
- **Guy Caruso,** Administrator, ENERGY INFORMATION ADMINISTRATION
- **David Fennema,** Managing Director, Biofuels, MARATHON CAPITAL LLC
- **Pam Serino,** Chief of Product Technology and Standardization, DEFENSE ENERGY SUPPORT CENTER

KEY REASONS TO ATTEND:

- **Uniting the entire biofuels value chain: meet and do business with the key biofuels stakeholders**
- **The most comprehensive biofuels meeting in the US: truly analyzing where the market is heading**
- **Unique networking opportunities: really understand the objectives of your principal clients and counterparts**

www.thecwcgroup.com

SPONSORED BY:

PetroSA

bp

PRODUCED BY:

the CWC group

CWC associates limited
STRATEGIC BUSINESS DEVELOPMENT
PARTNERS IN ENERGY & INVESTMENT

WINNERS OF:

THE QUEEN'S AWARDS FOR ENTERPRISE: INTERNATIONAL TRADE 2007

Driving the market forward

by Margaret Garn

Weaning people off conventional fuels is one thing, but asking the public to use relatively unfamiliar biofuels in their vehicles is quite another

Earlier this year a contaminated batch of fuel in the UK wreaked havoc on thousands of engines, causing many cars to break down. Unsurprisingly, consumers were less than pleased by the damage caused to their pride and joy. Although eventually traced back to silicon levels, and not biofuels as initially suspected, drivers around the world are now more sceptical than ever about what enters the tank.

Over the next few years the number of petrol forecourts selling biofuels will increase significantly. In order to reduce dependence on foreign oil, minimise costs and lessen the impact on the environment, each country has its own biofuels targets. The US wants to cut its petroleum use by 20% by 2017, and the European Commission wants 5.75% of transport fuels to come from renewable sources by 2010 and 10% by 2020.

This can be met in two main ways: introducing small blends of biofuel into standard fuel or selling high content biofuels. The former option is by far the easiest – by blending small quantities of bioethanol into petrol, or biodiesel into diesel, drivers are unlikely to even notice the difference.

Every little helps

One of Europe's largest biofuels producers and suppliers Greenergy supplies 5% bioethanol in all the petrol it manufactures. This ranges from its main grade (95 octane) petrol to the performance fuels, with higher octane levels. Because bioethanol is actually an oxygenate, with an octane rating of 135, it can increase power output in performance fuels as well as reducing carbon emissions.

'The 5% European bioethanol blending cap may be increased to 10% within two years'

Ewan Alexander, group product manager, Greenergy

All the fuel Greenergy supplies contains up to 5% biodiesel or bioethanol – a level consumers will hardly notice

In mainstream fuels, Greenergy is restricted in the amount of bioethanol it can blend into petrol by the European petrol standard, BS EN 228, which permits a maximum of 5%. The 5% cap is in place to ensure the fuel's quality, and is an agreement between the biofuels industry and vehicle manufacturers. As a result fuels containing 5% biofuels will not affect consumer vehicle warranties, and drivers do not have to be informed of the inclusion.

'You could potentially place 10% biofuel in fuels now,' says Alex Lewis, head of communications at Greenergy. 'But you would have to put up a sign warning drivers that the fuel could render their vehicle warranty exempt.'

Compared to other regions, this 5% limit is fairly low, and European standard bodies are in fasttrack discussions to increase this amount to 10%. 'There is pressure from all around – except the automotive industry,' says Lewis. 'It was set quite a while ago, when biofuels were pretty new and people were cautious.'

Ewan Alexander, group product manager at Greenergy believes the 5% European bioethanol blending cap may be increased to 10% within two years, and the biodiesel cap will not be far behind.

Leading automotive technology provider, Ricardo, is one company looking in depth at the effects of biofuels on engine performance. 'Beyond E10

current petroleum calibrations will struggle and customers could experience rough idle,' explains Karl John, business development manager for fuels and aftertreatment at Ricardo. 'Bioethanol has 30% less energy content than petrol, so with blends higher than 10%, and assuming there are no calibration changes, the car will have less power at wide open throttle. While producing the same power output, the fuel consumption will be greater.

Source: Ricardo

Together with its research partners in the energy and automotive industries, Ricardo is developing particulate measurement systems which focus on particle numbers as well as mass

The 5% limit only applies for consumer vehicles. Others, such as fleets, can come to individual agreements with their vehicle manufacturers. For example the UK's largest retailer Tesco is running its 2,000 trucks and vans on B50 (50% biodiesel) and every vehicle in the UK McDonalds' 155-strong delivery fleet will be converted to run on 100% biodiesel within a year.

Setting the standard

In the US, bioethanol has been blended into petrol at different levels for several years, both as a petrol extender (reducing the amount of petrol that is needed) and an octane enhancer. It is currently blended into nearly half of all petroleum sold and is an essential component of the US motor fuel market.

In one of the latest moves, the Californian Air Resources Board has decided to adopt a resolution stating that all refineries producing petroleum sold in the state will have to blend in 10% bioethanol. This is to coincide with the new fuel standards set by Governor Arnold Schwarzenegger that will take effect in late 2009 – the Low Carbon Fuel Standard (LCFS).

The first US state to mandate biodiesel is also proposing a new long-term plan that would require vehicles to fill up with 20% biodiesel blends by 2015. Minnesota's plan would mandate the highest biodiesel blend in the US, from its current 2%, over the next eight years. If approved by legislators, a B5 blend could take effect next year, rising to B20 by 2015.

Outside of Europe and the US, blending bioethanol and biodiesel into fossil fuel-based fuels is also common practice. In China the government is making E10 blends mandatory in selected provinces. In southeast Asia, Thailand will enforce a mandatory 2% biodiesel blend in all diesel next year and after this it will push for B5. The Philippines already mandates a 1% biodiesel blend and will soon increase this to 2%. It has also made it mandatory to blend 5% bioethanol with petrol by 2009, increasing this to 10% by 2011.

Over the limit

All vehicles can use these relatively low blends without requiring any engine modifications. But in order to fully satisfy governmental targets, higher biofuels blends need to be encouraged.

Bioethanol has corrosive properties and a larger oxygen content than petrol, so higher blends require adjustments to various engine parts and electronics. Because not all petrol forecourts supply these high blends, having a car which only runs on bioethanol is not yet feasible in most regions. There are currently more than 1240 refuelling stations offering E85 in the US. This equates to approximately 1% of the available refuelling stations. 'The main problem of encouraging this high blend is the lack of infrastructure,' explains John.

But as part of the Alternative Energy Act, this number is expected to increase significantly by 2010 as government supported bioethanol processing plants become operational. E85 is also widely used across parts of Europe, especially Sweden, and is gradually becoming more prominent in places such as France, Germany, and the Netherlands.

The practical option for using biofuels is to drive a flex fuel vehicle (FFV). These have an engine management system which detects which fuel is being used at any time, and adjusts the ignitions and engine timings accordingly. When bioethanol is not available, the car can run on petrol as usual.

E85 is the most common blend for Europe and the US because of the requirements for good start-up in cold conditions. For this reason, E85 is often seasonally

Source: EEMS

Bioethanol is being used in racing championships due to its high octane properties

adjusted to E60 or E70 when necessary in colder climates.

'In temperatures above around 10ºC there aren't any problems using E85,' says Alex Conger, CEO of US-based Full Flex International, one of the leaders in flex fuel conversion systems. 'But lower than this, blends such as E60 or E70 are more suitable.'

In Brazil, where a cold engine start is not an issue, E100 fuel (pure bioethanol) has been used for many years.

The DIY approach

In order to use E85, drivers can either purchase a FFV or

Source: Full Flex International

Bi-fuel converters can allow a standard car to run on high blends of bioethanol

convert their existing vehicle. Full Flex International offers a product called a Bi-fuel converter, which can be installed between the injector system and the car's computer and updates the electronic settings.

'If you put bioethanol in a standard car error messages will flash up because it has different characteristics to petrol,' explains Conger. 'Bioethanol has less carbon in it, so reacts slightly differently in the engine.'

In the US there are approximately 230 million vehicles on the road, and only about 6 million of them are FFVs. Using this technology, the majority of the cars would have the ability to run on bioethanol.

The Bi-fuel converter systems take about twenty minutes to install, and the cost varies on the unit, from around $300 (€ 220) for a four cylinder engine up to $500 for an eight cylinder. Once the system has been added, the car is able to run on high blends of bioethanol although a few additional changes are also sometimes needed. Because bioethanol is cleaner than petrol the first few times it is added to the engine it can release the existing dirt left there from conventional petrol. These deposits are lifted and caught in the filters.

If the car is fairly new this does not cause a problem, but in older cars the filters tend to get clogged. But once the filter has been changed once, it should not need to be changed again.

Harnessing the power

Although bioethanol may be cheaper than conventional petrol, it gives fewer miles per gallon, due to its lower energy content. 'From our tests we estimate it is about 2-20% less per gallon than petrol, but others have said it is as much as 30%,' says Conger.

Tony Pearson, manager of technologies and motor sports for Nissan US, says FFVs are not optimised for E85, so they experience a 10-15% drop in fuel economy. 'This varies on the way one drives, the air pressure in the tyres, and additional driving conditions,' he explains. 'For comparison purposes, aggressive driving habits can result in a 20% loss and low tyre pressure can reduce mileage by 6%.'

Many racing championships are now using bioethanol blends to exploit its improved performance levels. In the 2006 racing season, the Indy Racing League IndyCar Series was fuelled with a blend of 10% bioethanol and 90% methanol. Beginning with the 2007 racing season, all cars were fuelled with 100% bioethanol. Following suit, the American Le Mans Series also began using E10 earlier this year.

However, bioethanol only works as a high-octane performance fuel if the car is specifically designed to run on it. 'Future vehicles that are designed to run purely on E85, for example, could be further optimised than the current standard FFVs, which have to cope with anywhere between 0% and 85% ethanol – again the question of a sufficient fuelling infrastructure needs to be addressed,' explains John.

Available options

Although there are plenty of options available now, Virgin MD Sir Richard Branson's FFV of choice is the Saab 9-5 2.3t BioPower car. The BioPower range was launched in mid-2005 in Sweden, and has now been launched elsewhere in Europe, including the UK, Spain and Germany.

In 2006, Saab sold some 11,000 BioPower cars in Sweden, while 6,800 9-3 and

Source: Saab

UK Prince Charles test drives a flex fuel vehicle

9-5 BioPower models were delivered to Swedish customers in the first five months of 2007. Saab's range is optimised for enhancing performance using bioethanol's qualities. When the BioPower car is fuelled with E85, its advanced trionic engine management system operates the turbo engine at a higher combustion pressure, and gases are pushed through at a faster rate.

Joe Oliver, product communications manager for Saab UK explains that this produces more power. Because E85 has a different molecular structure to standard fuel, this can be done without causing premature detonation of the fuel/air mixture and damaging the engine. Therefore when the 2.0t BioPower engine is fuelled with just E85 the brake horsepower increases by 20% and the torque increases by 16%.

According to Saab, taking into account the increase in fuel consumption that occurs when driving on E85, the reduction of fossil carbon dioxide emissions on a well-to-wheel basis is still about 50-70%.

Saab is certainly not the only company offering FFVs to the market. In the US, there are FFV versions of cars, ranging from the Peugeot 206 to the Mercedes C-Class.

'It is the capability to reduce the dependence on petroleum fuels that is driving the need for FFVs,' explains Pearson. 'Although FFVs have been offered to the US consumer since the mid-1990s we are now starting to see the awareness, availability and government support for them. These factors will increase demand from today's levels.' Nissan offers two models to the US market that run on E85.

Ford was the first manufacturer to market a low carbon dioxide bioethanol powered car in Europe in 2001, and now the majority of manufacturers offer an environmentally friendly vehicle of some sort. 'Every car built in 2007 should be an FFV,' says Conger.

Biofuels are not the only option, however. Some manufacturers are exploring other possibilities including hydrogen, hybrid and electric cars.

Specifically produced FFVs are designed so they are bioethanol compatible. Because bioethanol can cause potential corrosion, the fuel tank, fuel lines, fuel injectors, anti-siphon device and dashboard gauges are modified slightly. Any part that comes in contact with the fuel has to be upgraded to tolerate the alcohol content. Normally, these parts include a stainless steel fuel tank and teflon-lined fuel hoses. According to Pearson, there is only one major additional part that is included on an FFV - the fuel sensor that detects the bioethanol/petroleum ratio.

Nowadays, many non-FFVs are built with these modifications anyway. 'The divergence between FFVs and non-FFVs is getting smaller,' says Ricardo's John. 'Manufacturers are using specific materials so cars are now more compatible with bioethanol than they used to be.'

Overcoming the challenges for running biodiesel

Similarly with bioethanol, diesel in Europe is often blended with biodiesel up to the 5% limit allowed under diesel quality standard BS EN 590. This can be up to 10% in other countries such as the US.

Although biodiesel can be used in an engine without requiring a FFV, putting higher blends of biodiesel into a diesel engine can cause problems, both in older and modern vehicles.

The PSA Peugeot Citroën group actively supports the use of biofuels, and says its engines can run on blends of up 10% bioethanol with petrol in the latest 1.6 litre engines and up to 30% vegetable oil-based methylester/diesel fuel.

Source: Ricardo

However this is only for HDI (high pressure direct injection) models produced after 1998. According to the former head of Peugeot's UK technical department, Ian Sedgwick, this is because cars manufactured before 1998 used mechanical injection systems, which are not as advanced as new models. 'Now the injection systems are electronically controlled and more precise, which will assist in the running of up to 30% biodiesel blends.'

With some manufacturers, it is often the case that older vehicles can run high biodiesel blends, whereas newer vehicles have difficulties. Challenges arise as the technology becomes more advanced and complicated.

John believes newer vehicles fitted with diesel particulate filters may struggle running blends of up to 30% biodiesel. Diesel particulate filters are ceramic devices that collect particles in the exhaust stream. The high temperature

Transient dynamometer tests are carried out on engines of all sizes

of the exhaust heats the ceramic structure and allows the particles inside to oxidise into less harmful components. This reduces engine emissions and minimises visible black smoke.

The issue with diesel particulate filters is that they require periodic regeneration, which is triggered by creating a temporary increase in exhaust temperature. In most systems this is done through post injection. The post-injected fuel burns on the catalyst rather than the combustion chamber, so raising the exhaust temperature. The problem is that post injection in itself tends to lead to fuel dilution of the oil – and the longer, heavier hydrocarbon fractions in biodiesel do not boil off as readily from the oil as those of regular diesel fuel.

As such, the oil breaks down fairly quickly and service intervals can be required more regularly.

A heated debate

PSA Peugeot Citroën was the first company to make diesel particulate filters standard fit on passenger cars in 2000, on the Peugeot 607. Sedgwick says the filters have no effect on the running of biodiesel. 'The filters are self-cleaning,' he explains. 'Peugeot even races its particulate filter equipped HDI RC Cup model on a 50% biodiesel blend with an unmodified engine.'

Bioethanol also has slightly heavier fractions than petrol, but not to the extent of biodiesel. Ricardo believes this is less of an issue, although high-end oil products are also sometimes recommended.

'Lots of R&D is being done on different oils and additives to find a potential solution to this problem,' explains John. 'But at the moment this remains a challenge. Having biodiesel in the engine degrades the lubricant more so than pure diesel, but this varies from manufacturer to manufacturer.'

Most consumers would be unwilling to choose a car which required shorter service intervals. This is a significant concern with running engines on biodiesel and is one reason why a low blend of a maximum of 5% biodiesel should be maintained for now.

This is again only the case with consumer vehicles. With off-road vehicles or some fleets, service intervals are centrally maintained.

New PSA Peugeot Citroën diesel engines have a guaranteed two year or 20,000 mile service interval. 'A 30% biodiesel blend does not reduce this length of time – there are no problems with the oil,' says Sedgwick.

He believes PSA Peugeot Citroën cars could potentially run on blends higher than 30%, but then fuel quality becomes an issue. 'If the biodiesel has the same volatility and lubricity as lower blends, you could use a higher blend, but you can't always guarantee this.'

Biodiesel can be produced from raw materials from waste cooking oil to vegetable oil. 'Quality is critical. Biodiesel needs to be produced in industrial scale plants to ensure that the gums, fatty acids, methanol and water are removed, as these can clog up parts of an engine,' explains Alexander. 'This is less important for low percentage blends, such as B5, but absolutely critical for high blends.'

High blends of biodiesel can also separate, and clog filters, if left standing for too long. '100% biodiesel should not be left standing for more than three months,' says Alexander. 'After this amount of time, the fuel can oxidise and go off-spec. But I wouldn't recommend leaving any fuel standing for more than six months, regardless of whether it is blended with biodiesel.'

> Biodiesel has slightly lower energy density than traditional diesel – 6% when using 100% biodiesel'
>
> Karl John, business development manager for fuels and aftertreatment, Ricardo

Spot the difference

Biodiesel and diesel vary in their viscosity, water and metal content levels. But how much disparity there is depends on the feedstock the biodiesel is produced from. Some heavy metals occur naturally in the raw materials, which can potentially be detrimental to vehicle catalysts.

The source of the biodiesel also has an effect on its performance. Biodiesel produced from waste cooking oil is liable to freeze in winter, so at these times of year lower blends should be used to avoid problems. Biodiesel produced from rapeseed or canola has better cold properties than biodiesel produced from palm, for example, although biodiesel produced from palm oil has a high, powerful, cetane number of 65 (the measure of the combustion quality of the fuel). These properties can be affected by the region in which the feedstock is grown. Companies such as Greenergy use a mixture of feedstocks to gain the optimum properties from each.

Pure biodiesel has a solvent effect. Similarly to bioethanol,

when used in an engine that has previously contained fossil fuel-based diesel, it can release the deposits which have accumulated on tanks, walls and pipes. This means the filters may require changing once after the first use, especially in older vehicles. Pre-1995 diesel vehicles may also have natural rubber fuel lines, which could be susceptible to slow degradation with biodiesel – these need to be replaced with biodiesel tolerant fuel lines.

'Biodiesel has slightly lower energy density than traditional diesel ~6% when using 100% biodiesel,' says John, 'but nothing like the scale of bioethanol.'

This is for 100% biodiesel blends, because biodiesel contains less energy than traditional diesel. 'Up to B50 a difference is not noticeable and with low blends such as B5 some drivers can actually experience a 1% or 2% increase in miles per gallon,' says Alexander. A B5 blend leads to a slightly higher density fuel and improved internal engine lubricity, which causes these effects.

Although carbon dioxide emissions are reduced when using biodiesel, oxides of nitrogen are increased, because the fuel contains oxygen. This leads to a heated debate over the resulting environmental benefits of using biodiesel over the conventional alternative.

Future outlook

Both biodiesel and bioethanol can be used in almost any vehicle on the road today in small quantities. But these levels are unlikely to meet any of the upcoming environmental targets. And it is when blends are increased that engine difficulties begin to arise. It is a constant battle between the oil and the automotive industries as to what is the optimum blend, and the best possible vehicle, and who will win the fight remains to be seen.

Staying on track

TRAINS TRADITIONALLY run on gasoil – one of the cheapest, dirtiest and most explosive forms of crude oil that an engine can run on. Also known as red diesel, it is found in the marine and construction industries.

Due to the amount of pollution gasoil emits to the environment, any movement to use biofuels in the train industry, will be welcomed by environmentalists. Earlier this year, Virgin Trains launched a six month trial for Europe's first train that can run on biodiesel without affecting the engine.

If this trial is a success, and Virgin Voyager's fleet is converted to B20, carbon dioxide emissions could be cut by 14%. If Virgin Trains converted its whole fleet to B20, it could save 40,000 tonnes of carbon dioxide a year. Although Virgin would like to use blends of up to B100, B20 was chosen as the highest biofuel blend that can be used without needing significant changes to the management software. Using B20 the fuel consumption also remains approximately the same as gasoil, explains David Edwards, Virgin Country project engineer.

'The UK rail industry will not run on any form of biodiesel if legislation is not put in place permanently to reduce the duty'

David Edwards, Virgin Country project engineer

In order to use a higher blend of biodiesel, the software which controls the train engine would have to be altered to cope with these changes, allowing the train to run only on biodiesel. Due to the limited biodiesel infrastructure in place, flexibility is required and this is not yet practical.

B20 is less explosive than pure gasoil because it contains less carbon and the cetane number and lubricity differ significantly. The cetane number (the measure of the combustion quality of the fuel) is greater with biodiesel, which can lead to improved fuel consumption and better combustion.

'Trials are ongoing to ascertain these levels as other factors affect it,' says Lee West, from Virgin Trains. Similarly with car engines, the increased lubricity in biodiesel can have a detrimental effect on the engine oil. When fuel is injected into the combustion chamber pre-ignition, it seeps round the piston and the piston rings. Over time this leads to a percentage of fuel in the engine oil, breaking down the lubricity of the oil in the process. Virgin Trains is doing trials to understand the rate of engine oil degradation, and the longer term effects of this.

A significant problem with running trains on B20 rather than gasoil is that it is 25% more expensive. The UK Treasury established new legislation for off-road trials of biodiesel to have a commensurate level of duty to gas oil. But the usual duty rate for B20 would be £0.55 (€ 0.80) a litre – considerably more than the £0.08 (€ 0.11) a litre paid for gasoil.

Off-road fuels are taxed at a different rate to on-road fuels, and these are marked with a red dye. But, because the red dye affects the anti-fungicide in biodiesel it cannot be added. Currently Virgin will have to pay on-road duty prices after the trial if it converted the Voyager fleet to run on biodiesel. 'The UK rail industry will not run on any form of biodiesel if legislation is not put in place permanently to reduce the duty,' explains Edwards.

Additives could be one way of bypassing the technical challenges involved with petroleum-ethanol blends

Overcoming the hurdles

It is well known that ethanol blends can present a plethora of technical challenges to engine operation because ethanol differs from petroleum in some key properties.

This leads to unique challenges – including intake valve deposits, increased valve sticking, cold-weather starting, fuel system corrosion, filter plugging and loss of fuel economy – that are as various as they are complex. To succeed in the market, producers and blenders must overcome these obstacles. Each presents an opportunity for additives, and data shows that correctly formulated additives can counteract many of these issues.

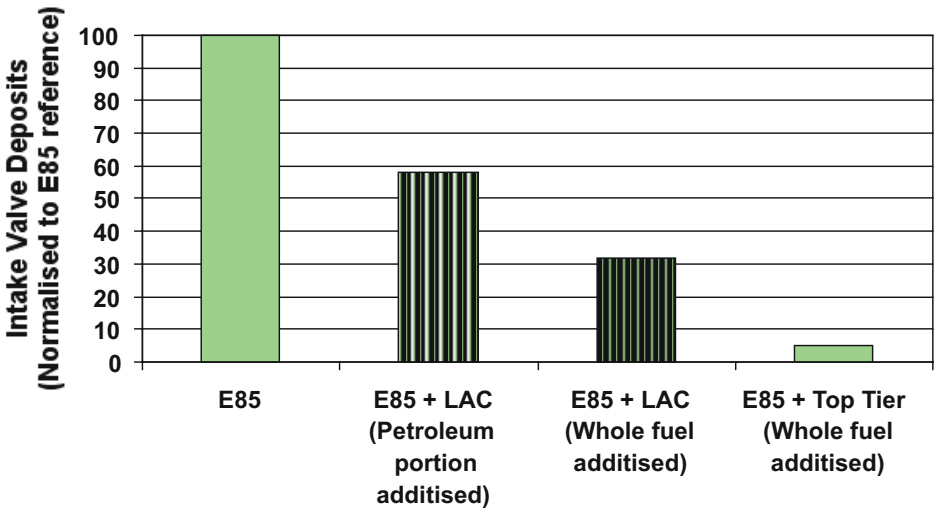
Intake valve deposits

Introducing low levels of ethanol to fuel can lead to moderately increased intake valve deposits. Inlet valves allow fuel into an engine. Deposits can accumulate on these valves due to the characteristics of the fuel or the engine design – for example the level of exhaust gas being re-circulated as part of the emission control system.

However, using proper deposit control additives (generally a multi-functional package containing detergents and other active chemistry) and choosing the correct treatment level can improve performance in these situations.

The type and treatment level of additives is also important for higher level ethanol blends such as E85.

E85 test using four additive doses:



The results shown in the graph above are:

- When only the petroleum portion contained the minimum required dose (US EPA LAC), so the E85 contained only 15% of LAC, an unacceptable level of deposits compared to the reference was observed, with a minor reduction to 58% of deposits compared to the baseline
- When the whole fuel blend was additised with the minimum additive dose (US EPA LAC level), improved performance was seen, with deposit reduction of about 1/3 of the unadditised fuel deposits
- When the whole fuel blend was additised with a soluble, differentiated additive meeting US Top Tier performance specifications, a deposit reduction of 95% was observed.

Reports from countries using E25, E85 and even E100 indicate the blends often produce lower deposit levels than petroleum alone. There are several theories about why this occurs. Ethanol could dilute some of the petroleum components that are known to create intake valve deposits. Ethanol also has a much higher vapourisation temperature than petroleum. The result should be intake port and valve cooling as the fuel changes from liquid to gas. It is generally accepted that valve temperature plays a key role in deposit formation.

While conventional additives used in petroleum and E10 may not be suitable for E85, special additives can be formulated to control intake valve deposits when E85 is used in flex fuel vehicles.

Ethanol and petroleum properties:

Ethanol	Petroleum
Specific gravity = 0.794 g/mL	Specific gravity = 0.72-0.78 g/mL
Boiling temperature = 77.8°C	Boiling range = 27-225°C
Flash point = 12.8°C	Flash point = -42°C
Energy content = 23,550 kJ/kg	Energy content = 44,540 kJ/kg
RVP = 15.8 kPa	RVP = 55-103 kPa
Blending octane RON = 120-135 MON = 100-106	Octane RON = various MON = various

Valve sticking

If multi-functional additives are used at high levels and are incorrectly formulated, the additive can collect on the stem of the valve and form a

gelled, glue-like material, causing it to stick open, resulting in loss of compression and poor starting problems.

Ethanol is believed to contribute to sticking intake valves, perhaps by reducing the ability of the fuel to solubilise or by increasing its likelihood to build up residues between the valve guide and stem.

Properly formulated additives can effectively address valve sticking tendency, and this is a regular part of industry no-harms testing.

Cold-weather starting

Vehicle operators need to take special care to ensure cold-weather starting when using E85. The reason is the difference in volatility between ethanol and petroleum. Because petroleum is a mixture of C4-12 isomers, it has a range of boiling and ignition temperatures.

On the other hand, ethanol is a distinct chemical with specific properties. At temperatures below -6°C (20°F), E85 (or higher) does not have the required volatility to support combustion. Typically in this situation, more petroleum (up to 30%) is added to the blend to ensure efficient engine starting.

Filter plugging

Ethanol-related filter plugging has been linked to sodium and ammonium sulphate contamination, possibly in combination with certain types of fuel additives. The concern that methanol or ethanol contaminants in high-level alcohol blends could cause vehicle and distribution system filtration issues is not new.

The choice of improper additive chemistry could lead to similar issues if the additive is not fully soluble in the fuel. And, traditional petroleum detergent additives can have solubility problems in alcohol fuels, leading to sediment formation and filter plugging. However, special E85-compatible additives can be formulated to be soluble while providing deposit control in alcohol fuels.

Fuel economy

Inherently, ethanol has less energy content (but higher octane). Therefore, ethanol-blended fuels are expected to be less energy efficient than petroleum. With E10, the expected loss is 5% to 6%. Fuel economy losses increase with the ethanol content, reaching about 25% for E85.

Although it is not possible to eliminate the reduction of fuel economy, it can be partially mitigated using additives designed to reduce friction in the engine.

Future outlook

Historically, minor changes in fuel can have a significant impact on performance. Use of conventional petroleum additives in ethanol does not always have the desired effect. For trouble-free operation, it is essential to use additives that have been properly formulated for use in ethanol-containing fuel. ●

This article was written by: Steve Talbot, global business manager for gasoline additives, Lubrizol, with the assistance of his colleague Jon Villardo

Cracking up

Ethanol's corrosive properties mean that a protective environment is required, from the initial stages of manufacture through to final distribution

Stress corrosion cracking (SCC) can pose a serious risk in the distribution, storage and handling of fuel ethanol. This is the conjoint action of stress and a corrosive environment, which leads to the formation of a crack. It can happen unexpectedly and rapidly after a period of satisfactory service, leading to catastrophic failure of structures or leaks in pipework.

The stresses that cause SCC are either produced as a result of the use of the component in service or residual stresses introduced during manufacture. Cracking often occurs at stresses less than normal design levels, but local and dynamic stress/strain can also be significant.

The corrosive environment is generally the permanent service environment. SCC can be controlled by either: selecting a material that is not susceptible to the service environment – ideally done at the initial design stages; controlling the service stresses through heat treatments and careful design to minimise stress concentrations; or through controlling the corrosive environment – achieved by the addition of a suitable corrosion inhibitor to the fuel ethanol.

Fuel additive company SBZ Corporation offers a special corrosion inhibitor expressly for this purpose. Testing has demonstrated excellent corrosion protection once the inhibitor has been added at the recommended dose rate.

Protection is provided for storage and downstream distribution facilities whatever the product blend (E100-E5). To optimise protection, SBZ Corporation recommends the inhibitor is added as soon as possible in the manufacturing process.

SBZ Corporation has also developed a special fuel additive named SBZ 1895. This is a proprietory blend of methanol, denatonium benzoate and a specially selected corrosion inhibitor. It has been formulated to denature bioethanol and protect materials from corrosion. ●

For further information please contact: www.sbzcorporation.com or sales@sbzcorporation.com

Ethanol by-products can provide an important revenue stream for producers, but effective drying systems are needed before companies can take advantage of this

The hunt for cleaner, more successful drying

When producing ethanol from grain a by-product is left behind, stillage. This can be further processed to produce animal feed additives, but in order for it to be used for this application it must be dried.

The first step is spinning the stillage in a centrifuge to increase its solids content to 30-35%. The liquid and dissolved solids spun out during centrifuging form a thin stillage that is reduced by an evaporator system to a syrup.

Next, the centrifuge solids and the syrup are recombined and mixed with enough recycled final dry product to achieve a blend with 65% to 75% solids. This blend is fed to a drying system, which yields a final dry product called distiller's dried grain with solubles (DDGS), which ethanol plants can sell for use as a high protein animal feed additive.

The drying process is one of the most energy intensive in an ethanol plant. Having an energy optimised drying system that is integrated into the overall production process can reduce this energy consumption significantly.

Conventional drying systems

Most of the conventional drying systems are direct-heated rotary drum dryers. Hot, dry flue gas from a natural-gas-fired furnace is in direct contact with the product to be dried in the rotary drum. High temperatures cause the particles to burn and increase the gasification of organic compounds.

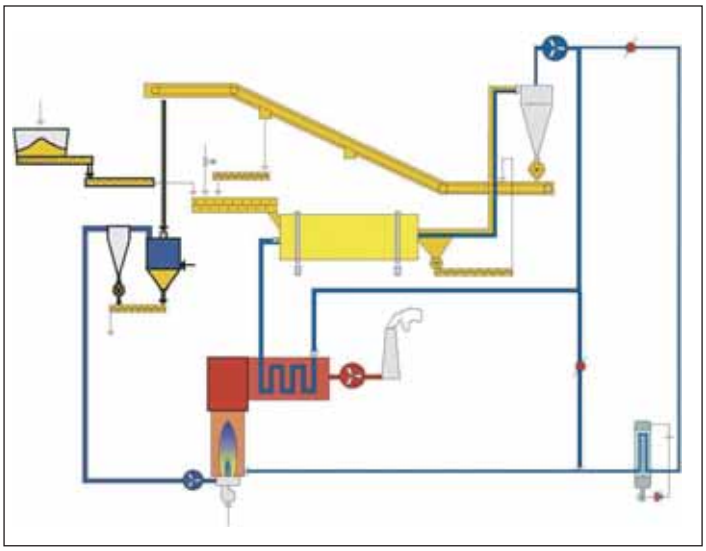
The exhaust gas from the dryer has to pass further process steps to remove entrained particles and air pollutants such as VOCs. This end-of-pipe solution such as a scrubber, filter or regenerative thermal oxidiser, adds another layer of maintenance and fuel cost. To reduce the exhaust gas flow and the heat consumption a part of the hot exhaust gas can be recycled back to the furnace.

New technology

Swiss Combi (also known as W. Kunz dryTec AG) offers a patented drying system called ecoDry with a closed-loop operation and an integrated thermal oxidation of the dryer exhaust gas. This not only eliminates any need for post-treatment of the dryer's exhaust gas but allows drying energy to be recycled back into the system and related equipment.

This system consists of several pieces of equipment connected by ducting in a closed-loop configuration. Its centrepiece is a gas/gas heat exchanger to separate the exhaust from the drying gas. This heat exchanger is specially developed to withstand rough conditions with high temperatures (up to 900°C at the inlet) causing strong heat dilatation.

Another key-component is the single-pass drying drum, designed for a low pressure drop, a wide tolerance for product variation and high throughput rates. This is essential due to the high product recycling rates, especially required in drying DDGS from wheat. The drum's cylindrical housing rotates on four independently driven, variable-speed trunnion rollers at a speed that can be easily adjusted to control the product's moisture content and throughput rate.



The ecoDry principle

Other equipment includes a gravimetric dosing bin, a single-shaft high-speed paddle mixer, a natural gas fired furnace with the possibility to co-fire alternative fuels (e.g. biogas, fusel oils), a cyclone, a product cooler, and a series of tightly sealed mechanical conveyors. The system can be linked to an ethanol plant's evaporator system for heat recovery.

In operation, wet cake (the grain solids) from the centrifuges discharges into the dosing bin, which is mounted on load cells and has a dosing screw discharge to a transport screw conveyor. The bin monitors the centrifuge output and automatically controls the wet feed flow through the screw conveyor to the mixer, where the feed is blended with syrup from the evaporator system and the recycled dry product. This feed mixture continuously discharges from the mixer and is hurled into the adjacent rotary drum.

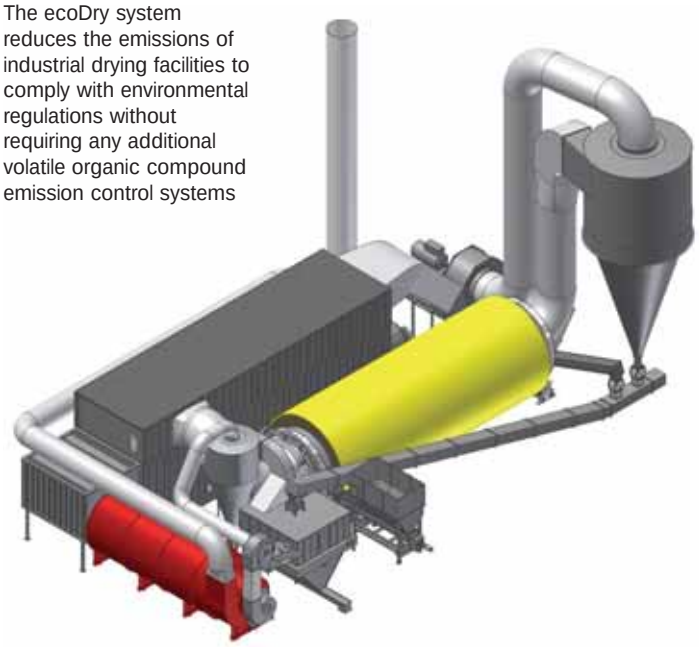
Flue gas from the furnace passes through the heat exchanger, where it heats the steam to approximately 450ºC. The superheated steam passes through the dryer, directly contacting the wet feed mixture to heat it and evaporate moisture. The drum rotation and mechanical assistance inside the drum, combined with the steam flow, move the product toward the dryer discharge.

Most of the product – now DGGS – is discharged through a rotary valve to a tightly

sealed mechanical conveyor, but the fines and steam pass on to the cyclones. After separating entrained particles from the steam in the cyclone the still superheated steam is recirculated through the closed loop ductwork back to the heat exchanger. These particles are dropped back into the mechanical conveyor, which transfers all the still-hot DDGS to a cooler that circulates ambient air in a counter-current pattern to reduce the product's temperature.

As the cooled DDGS discharges from the cooler, the cooler's heated exhaust air is routed back to the furnace air intake as primary combustion air. In a process called internal thermal oxidation, the furnace incinerates pollutants entrained in the cooler's exhaust air.

After the steam exits the cyclone, the evaporated water and leakage air is bled off and can drive the plant's evaporator system. The remaining steam and non-condensable are routed to the furnace as secondary gas so it can be thermally oxidised. The drying system's automatic control system adjusts the amount of steam that is bled off to the evaporator system in response to pressure conditions inside the dryer. The steam routed to the evaporator system enters it at approximately 120°C (about 95°C wet bulb temperature).



The ecoDry system reduces the emissions of industrial drying facilities to comply with environmental regulations without requiring any additional volatile organic compound emission control systems

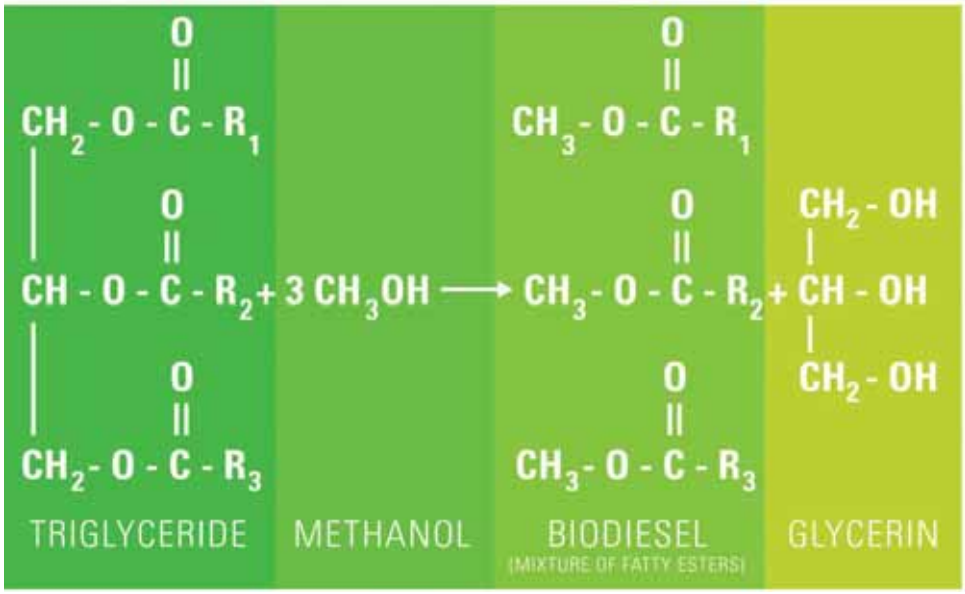
Quality control

When it comes to checking biodiesel, reliable testing methods are crucial

Fuels and fuel additives manufactured or imported in the US are subjected to strict regulations set out by the US Environmental Protection Agency (EPA). Biodiesel is the only alternative fuel to be legally registered with the US EPA and to have fully completed the health effects testing requirements of the 1990 Clean Air Act Amendments. Furthermore, pure biodiesel (B100) has been designated as an alternative fuel by the Department of Energy (DOE) and the US Department of Transportation (DOT).

In order for biodiesel to be sold as a fuel or blending stock, it must meet a set of requirements defined in ASTM D6751 and EN 14214, which specify the maximum allowable concentrations of contaminants in B100 finished products. Biodiesel must be produced to these strict specifications in order to ensure optimum engine performance as well as safe operation. Additionally, testing laboratories and regulatory agents must ensure that the labelled blend levels are present exactly as stated.

Effective testing of biodiesels is essential to identify compound types and values. US-based analytical equipment supplier Thermo Fisher Scientific provides a wide range of complementary analytical techniques for the quality control of biodiesel and the identification of labelled blend levels. These solutions comprise a variety of techniques including gas chromatography (GC), infrared spectrometry (IR), liquid chromatography/mass spectrometry (LC/MS) and



The chemistry of transesterification

inductively coupled plasma spectroscopy (ICP).

Gas chromatography

GC analysis is a reliable and effective method for the quality assurance of biodiesel. The technique comprises a range of variations that respond to differing ASTM methods.

As specified in ASTM specification D6751, biodiesel should not contain a level of total glycerin which exceeds 0.25%. Glycerin reflects the quality of biodiesel: low levels of total glycerin ensure high conversion of the oil, while high levels of glycerin and glycerides can cause injector deposits, clogged fuelling systems and can affect cold weather operation. It is also necessary to monitor residual methanol in B100 blends, since even small amounts of this material can reduce the flash point (the temperature at which the fuel will produce a flammable mixture). Moreover, residual methanol can affect fuel pumps, seals and elastomers and can result in poor combustion properties.

The analysis of free and total glycerin, FAMEs and residual methanol requires a non-discriminative injection system capable of transferring both volatile and heavy compounds. Regulations recommend GC analysis for this application, as this technique is capable of accurately and reliably testing the content of free and total glycerin, FAMEs and residual methanol in B100 blends. The Thermo Scientific TRACE GC Ultra delivers reliability and precision for successful determinations of biodiesel contaminants. The instrument is capable of performing analyses up to 30 times faster than with conventional GC and MS detectors, resulting in a significant increase in sample throughput.

The GCxGC technique provides an effective solution for characterising biodiesel blends by increasing the chromatograph's power by up to 10 times when compared to conventional GC systems. The instrument not only simplifies sample preparation procedures but also provides higher sensitivity, resulting in the most suitable solution for the analysis of target compounds in complex matrices, as well as for detailed sample characterisation. The TRACE GCxGC improves both qualitative and quantitative analyses by ordering compounds according to their chemical and physical properties. The results are presented in a structured 3D chromatogram and identification is based on a set of retention times.

The GCxGC approach provides information about multiple biodiesel blends at once. It achieves petrodiesel compositional characterisation, determines the biodiesel percentage content in the blend and details the FAMEs composition, delivering valuable information such as the type of oil used, the origin

of the biodiesel and the cetane index, plus pour point evaluation. Quantitative results achieved have been reliable and highly reproducible.

Liquid chromatography/ mass spectrometry

While the determination of glycerins in biodiesel is traditionally achieved using GC, this technique is not convenient for the analysis of non-volatile acylglycerols. However, LC/MS can be adapted for non-volatile component analysis. When using hyphenated methods, the compounds obtain unique spectra, eliminating uncertain values, which can result from the use of chromatography. In general, using a spectroscopic method of detection in combination with a chromatographic one yields more detailed information.

The LC/MS approach, using the Thermo Scientific Accela high speed LC and MSQ Plus single quadrupole mass spectrometer with electro spray ionisation (ESI), permits the analysis of biodiesel to be achieved in 20 minutes compared to 45 minutes with GC and 60 minutes with conventional LC/MS methods. The extended mass range of this instrument combined with its ability to inject, separate and ionise compounds provides data compliant with ASTM regulations. A continuous flow of 80µL/min methanol eliminates any possible deposition and blockage, resulting in uninterrupted analysis of even complicated sample matrices.

Infrared spectroscopy

During biodiesel production, alcohols are reacted with vegetable and animal oils. This process produces glycerol and FAME. The glycerol must be removed to ensure biodiesel quality, as it can clog the engine injectors. Fourier transform infrared spectroscopy (FT-IR) can be used to examine both the production process for FAME, looking for materials such as unreacted fatty acids and glycerol, and the blended fuels to validate percentage FAME content.

FT-IR provides a rapid, precise and accurate tool for biodiesel analysis. This method is particularly easy to use and requires no derivatisation.

FT-IR can give both qualitative (identity) and, with proper calibration, quantitative (concentration) information about the biodiesels. The Thermo Scientific Nicolet 380 Fourier FT-IR spectrometer coupled with the Thermo Scientific Smart ARK attenuated total reflectance accessory enables the user to collect the required data ensuring reproducible, reliable measurements in the mid-IR regions. An analysis on the Nicolet 380 requires seconds, from sample introduction to quantitative results. The unique patented crystal design of the Smart ARK allows analysis of samples from pure FAME (B100) down to below 2% FAME, using the same calibration parameters, by permitting the changing of crystal angles and materials without optical realignment. The user can then analyse samples over the full range of concentrations with high sensitivity. Thermo Fisher Scientific has worked closely with the regulatory agencies in developing and validating FT-IR for these purposes.

Inductively coupled plasma

In addition to the applications, the elemental analysis of biodiesel and biodiesel blends has also become increasingly important over the last decade. This is due to the steady trend to promote low-sulphur and low emission diesel fuels in the EU and other parts of the world. Currently, the maximum allowable concentrations for the various elemental impurities are easily achievable with biodiesel production methods.

Rapid elemental analysis during all stages of production and blending can greatly assist with effective quality control, reducing costly production and blending issues

Biodiesel is almost totally free of sulphur and is suitably low in other elemental compounds, which makes it an excellent blending partner for use with fossil fuels, producing a final fuel with reduced impurity content. Rapid elemental analysis during all stages of production and blending can greatly assist with effective quality control, reducing costly production and blending issues to ensure a better quality final product.

ICP spectrometry has long been a cost-effective tool for rapid, multi-element analyses. It is suitable for all concentrations from ultra trace levels to major components. A complete multi-element analysis can be undertaken in a period as short as 30 seconds, consuming only 0.5ml of sample solution.

The elemental analysis of biodiesel can present certain challenges to ICP instrumentation, which must be met to produce credible results. An effective ICP instrument requires:

- Good organic capabilities – preferably the ability to analyse undiluted biodiesel at ambient temperatures, reducing evaporation and dilution errors while increasing sensitivity
- Robust, rapid response RF generator to handle the high plasma loading from organic sample introduction
- High resolution optics for peak separation
- High saturation resistance for the detector to resist blooming due to high C and C2 emissions

The Thermo Scientific iCAP 6000 series emission spectrometers meet all the above criteria. The iCAP 6000 series comprises the most sensitive and compact ICP emission spectrometers available on the market. Featuring good detection capability, they are up to five times more powerful than conventional instruments while keeping annual operation costs at a minimum.

The definition of pure biodiesel along with physical and chemical property limits is established by official quality specifications with which the composition of pure biodiesel must comply either for its pure use or prior to blending with mineral diesel. A range of analytical tools can be applied for the analysis and quality control of biodiesels, including GC, IS, LC/MS and ICP spectroscopy. ●

This article was written by: Fausto Munari, Daniela Cavagnino, James Chang, Andrea Cadoppi, Mike Bradley and Paul Neal, Thermo Fisher Scientific

The Storage Terminal Operators' Conferences & Exhibitions

STOCEXPO MIDDLE EAST

19-20 November 2007

Gulf Hotel, Bahrain

STOCEXPO RUSSIA & THE BALTIC

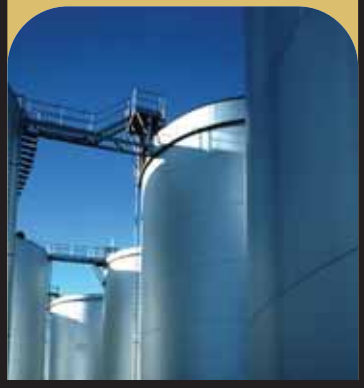
26-27 February 2008

Finnexpo, Helsinki

STOCEXPO EUROPE

1-3 April 2008

Ahoy, Rotterdam



STOCEXPO ASIA

October 2008

Suntec, Singapore

StocExpo is the Storage Terminal Operators' conference and exhibition, designed specifically to bring together bulk liquid terminal operators with suppliers from around the world. The conference and concurrent exhibition allows enlightened discussion relating to the safe and efficient operation of today's chemical and oil terminals.

Who should attend: Terminal managers • Commercial and business development managers • Inspection and maintenance personnel • EHS managers • Security managers • Procurement managers • Tank engineers and technicians • Suppliers and product manufacturers

To book a stand at all the exhibitions please contact

Niké Ajibode on +44 (0)20 8648 7078 or email your requirements to: nike@stocexpo.com

For clients in Australasia and Pacific regions please contact Anthony Chan on +65 6345 7368 or email: acesap@singnet.com.sg

For more information and to register to attend these events visit our website:

www.stocexpo.com

An environmental dilemma

by Patrik Wheater

The cost of global economic expansion since the west's industrial revolution in the late 18th and early 19th centuries can be measured quite simply in terms of the increased level of greenhouse gas concentrations emitted to the atmosphere.

Today the amount of carbon dioxide equivalent (CO^2e) in the atmosphere is about 430ppm, compared with only 280ppm before the advancement of industrial technologies. And according to figures quoted in the Stern report this figure is set to rise even further. Lord Stern prepared this report for the UK Government in October 2006.

'Without action to combat climate change, atmospheric concentrations of greenhouse gases will continue to rise. In a plausible business as usual scenario, they will reach 550ppm CO^2e by 2035, and then increase at 4.5ppm a year onwards. Most future emissions growth will come from today's developing countries, because of more rapid population and GDP growth, and an increasing share of energy-intensive industries,' warns Stern in his report.

Yet while increased use of biofuels is seen as the solution to reducing the impact of fossil fuel emissions, what exactly are the emissions savings and will the increased use of biofuels curb the effect that burning fossil fuels has?

Biodiesel is traditionally thought of as being cleaner than traditional diesel, although nitrous oxides (NOx) have been found to increase significantly when biofuels are burned, leading some regulatory bodies, particularly in the US, to consider banning the use of biodiesel altogether.

This stance is largely based on research carried out by the US Environmental Protection Agency (EPA), which conducted a comprehensive analysis of the emission impacts of biodiesel using publicly available data. The majority of the data was collected on heavy-duty motorway engines and formed the basis of its analysis, although the database contained no engines equipped with exhaust gas recirculation systems, NOx adsorbers, or particulate matter traps and filters.

Emissions levels vary

The investigation discovered that biodiesel impacts on emissions varied depending on the type of biodiesel (soybean, rapeseed, or animal fats) and on the type of conventional diesel to which the biodiesel was added. With one minor exception, emission impacts of biodiesel did not appear to differ by engine model year.

The motorway engine-based correlations between biodiesel concentration and emissions were also compared to data collected on non-road engines and light-duty vehicles. On the basis of this comparison, the EPA could not say with confidence that either of these groups responded to biodiesel in the same way that the heavy-duty motorway engines did.

Do the increased NOx emissions from burning biofuels, together with the emissions related to feedstock production, render the increased use of biofuels ineffective at meeting climate change requirements?

They were therefore unable to make any predictions concerning the impacts of biodiesel use on emissions from light-duty diesel vehicles or diesel-powered non-road equipment.

Ozone depletion

However, the emission impacts of B20 soy-based biodiesel blended with a standard fuel was found to decrease, with the exception of NOx. The fact that NOx emissions increase with increasing biodiesel concentration could be a detriment in some areas, says the EPA.

The study found decreased emissions in particulate matter (-10.1%), hydrocarbons (-21.1%) and carbon monoxide (-11%) but a 2% increase on NOx emissions. For B100 fuels, EPA analysers found that hydrocarbon, particulate and carbon monoxide emissions decreased further, by -67%, -47% and -48%, respectively, but NOx emissions levels jumped to 10%.

The EPA says in its analysis that this increase in NOx emissions is a potential drawback to the use of biodiesel. Although acknowledging the increase is small in comparison to the reductions in other regulated pollutants, such NOx increases may be problematic for ozone maintenance areas.

More research needed

Additional research is required on ways to mitigate the NOx increase. This might include using a lower-emitting base fuel for blending, adding a cetane improver to the biodiesel blend, or determining what source or properties of biodiesel can be modified to lower NOx emissions. Other strategies might be hardware-related, such as changing injection timing or adding a lean NOx catalyst.

The impact that increased NOx emissions might have on the expansion of biodiesel markets has been the main driver behind National Renewable Energy Laboratory (NREL) research into the effects of biodiesel blends on vehicle emissions. While biofuels emissions remain a complex and contentious issue, the objective of the NREL study was to examine the test data from which the EPA concluded that soy-based biodiesel resulted in a 2% NOx emission increase.

Biodiesel emissions levels vary depending on the feedstocks used

The NREL research found, through careful examination of the test data on which the EPA conclusions were based, that 44% of its observations centred on engines from a single manufacturer, Detroit Diesel, and a large majority of these engines were for one particular engine model, the Series 60 model.

The authors of the NREL study write: 'Because data for the Series 60 engine, which typically exhibits a small NOx increase for B20, makes up such a large fraction of the data reviewed, the EPA draws a conclusion that is at odds with the results of more recent studies.' Other studies have found an average change in B20 NOx varying between -0.6% and 2.0%, but this depends on engine and vehicle type.

In the NREL research, eight heavy-duty diesel vehicles were tested, including three transit buses, two school buses, two trucks, and one motor coach. Four of these met the 1998 heavy-duty emissions requirement of 4g/bhp-h/NOx and four met the 2004 limit of 2.5g/bhp-h/NOx and hydrocarbons.

Road tests

The tests simulated both urban and motorway driving patterns and each vehicle was tested on a conventional diesel and on a 20% blend of that fuel with soy-derived biodiesel. It was found that, on average, use of B20 fuel caused particulate and carbon monoxide emissions to be reduced by 16% to 17% while hydrocarbon emissions were reduced by 12%, relative to the combustion of conventional diesel fuel.

The NOx impact of B20, however, was found to vary with engine/vehicle technology and test cycle, ranging from -5.8% to 6.2%. A preliminary examination of real-time NOx emission data did not reveal any consistent reason for the wide range and on average NOx emissions did not change (0.6% ±1.8%). The authors say that if the results of this study are combined with the results from other recently published studies, then the average change in NOx emissions is 0.9% ±1.5%, based on data for 15 vehicles.

Negligible NOx

'Individual engines may show NOx increasing or decreasing, but on average there appears to be no net effect, or at most a very small effect, in the order of ±0.5%,' says NREL. 'The small apparent increase in NOx reported for engine testing results in EPA's 2002 review occurred because the dataset was not adequately representative of on-motorway engines. However, considering all of the data available, we conclude that B20 has no net impact on NOx.'

However, conclusions to a study carried out by the University of Denver appear to oppose the NREL findings. The researchers conducted on-road emissions tests using dispersive infrared and ultraviolet spectrometers to analyse the exhaust plumes of over 20,000 vehicles passing through a motorway junction over a three day period.

The tests focused on comparing emissions from four different fuels. First, a truck ran on regular diesel to obtain a baseline level for analysis and then two blends of biodiesel were tested: B20 and B100. A vehicle was also tested on straight vegetable oil, for which a special tank containing a heating element needed to be constructed.

By benchmarking the emissions of the vehicle running on biofuels against those running on traditional diesel fuel, researchers observed a reduction in carbon monoxide emissions as well as an increase in NOx with the use of biodiesel. When the engine was running at idle, they found a 10% reduction in carbon monoxide with the B20 fuel. The reduction,

however, did not extrapolate linearly with the use of B100 fuel, although carbon monoxide emissions did decrease further with pure biodiesel, to about 15%. NOx meanwhile, increased for both B20 and B100 fuels by about 10%.

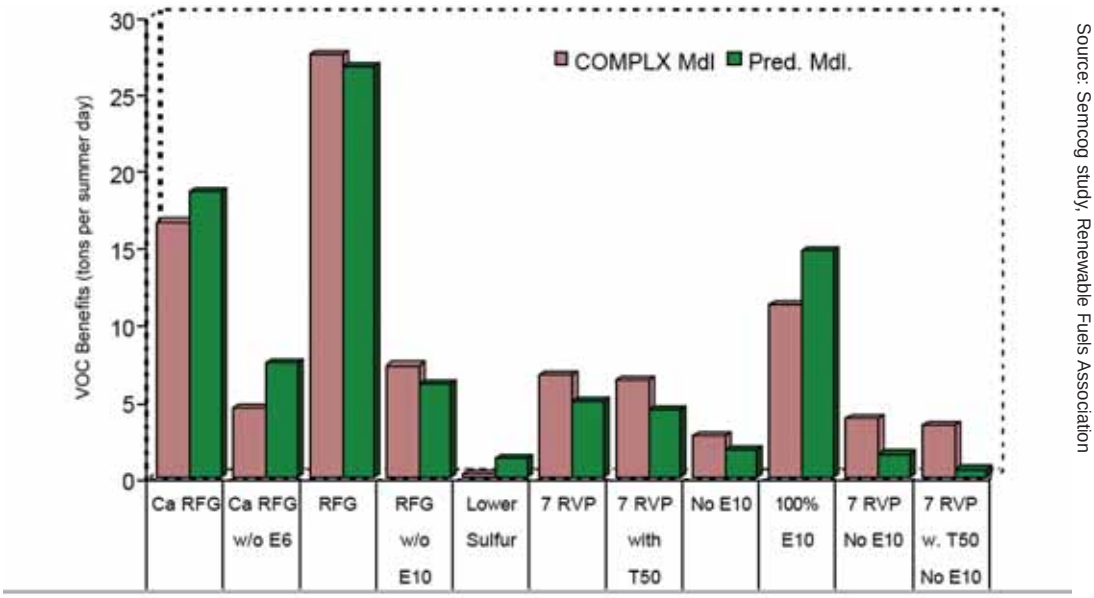
According to these studies the reduced carbon monoxide emissions is a result of the processes taking place in a lean-burn internal combustion engine. Because biodiesel is approximately 10% oxygen by weight, there will be extra oxygen to react with during the combustion process, allowing for more complete burning, which ultimately reduces the emission of carbon monoxide.

Biodiesel also has a lower carbon-to-hydrogen ratio than conventional diesels and those blends with the lowest carbon content formed the least carbon monoxide, while all biodiesels emitted less carbon monoxide than petroleum diesel.

This is largely because with less carbon in the fuel, there is a better chance that each carbon atom will find two oxygen atoms to bind to. Additionally, when engine loads increase, carbon monoxide emissions decrease. This is because the cylinder temperature increases, speeding up the conversion of carbon monoxide to carbon dioxide to complete the combustion process and lower carbon monoxide emissions.

Less oxygen, less NOx

The factors that go into NOx formation were found to be more complex. Research has found that thermal NOx is formed at high temperatures in the combustion chamber where oxygen combines with nitrogen from the air. The rate of this reaction is dependent on temperature, so thermal NOx production will speed up rapidly as the cylinder temperature increases. NOx values were found to peak when the engine



Source: Semcog study, Renewable Fuels Association

Net VOC-equivalent benefits (includes net VOC emissions and CO emissions converted to VOC-equivalents)

load increased on the motorway test.

Ostensibly, the oxygen content of the biodiesel is the reason why NOx emissions increase and because the fuel itself contains oxygen, there will be more oxygen available to react with the nitrogen in the air. However, some of the biodiesel fuels tested had different properties, comprising a higher cetane number and lower energy content – factors usually associated with lower NOx. The properties of biodiesel can combine with or oppose each other to deliver differing degrees of NOx emissions.

A study carried out by the Department of Agricultural Engineering at the University of Idaho in 1994 corroborates this. From dynamometer tests it conducted NOx emissions varied widely. NOx started at 6.2gm/mile for diesel and fell to around 6 gm/mile with 100% ester biodiesel, with slightly more reduction with rapeseed ethyl ester than rapeseed methyl ester. Emission results for 100% ester compared with conventional diesel fuel showed a 53% reduction in hydrocarbons, a 50% reduction in carbon monoxide, a 10% reduction in NOx and a 13.6% increase in particulate matter.

Studies of corn ethanol do suggest that small greenhouse gas savings of 13% can be gleaned compared to petrol, but only if soil erosion and land conversion are ignored

The case for bioethanol

Although not coming anywhere near the scrutiny that emissions from biodiesel has been subjected to, a 2005 report prepared by the Renewable Fuels Association, provides a sound case for the use of 100% E10 as a positive strategy for southeast Michigan and other areas around the country to help obtain the federal ozone standards.

The report entitled Emissions reductions from changes to gasoline and diesel specifications and diesel retrofits in the southeast Michigan area (SEMCOG) suggests that given the reduction of volatile organic compound (VOC)-equivalent emissions with ethanol and only a slight NOx increase, using 100% E10 would reduce smog formation.

'It is generally known that ethanol in petroleum reduces exhaust hydrocarbons and carbon monoxide emissions from on road and off road vehicles and equipment,' cites the report. And taking the southeast Michigan area as an exampled, if ethanol were not used, carbon monixide emissions would increase by roughly 80 tonnes a day.

However, predictive model tests have pointed to a small increase in NOx emissions for ethanol, and while results could be susceptible to overestimation, data from the Auto Alliance suggests this supposed NOx increase for newer cars does not exist.

Studies of corn ethanol, one of the biofuels for which most research evidence is available, do suggest that small greenhouse gas savings of 13% can be gleaned compared to petrol, but only if soil erosion and land conversion are ignored.

Does the solution to reduce bio-NOx sit with the engine manufacturer?

AFTER-TREATMENTS can be used to minimise engine emissions. One method mooted for reducing NOx emissions, which contribute to smog and ozone, is exhaust gas recirculation (EGR) systems, which can reduce engine temperature by pumping a portion (10-25%) of exhaust gas back into the intake. Because the exhaust gas is more or less inert, it will not react in the engine's combustion chamber and acts only as a heat sink. According to research a small power loss is associated with these systems, but NOx emissions decrease by up to 80%.

Another option is the catalytic converter but these are claimed not to be as effective on a diesel engine. They work better at high temperatures, and diesel exhausts are generally not as hot as petroleum exhausts.

Selective noncatalytic reduction, diesel oxidation catalysts, water-fuel emulsions, and NOx and particulate traps have also been used to reduce NOx emissions on biodiesel engines. A particulate trap is a ceramic filter within the exhaust system of a diesel engine that captures particulates before they can enter the atmosphere. The captured particulates are burnt off during the operation of the vehicle using advanced control systems, catalytic coatings or fuel-borne catalysts (FBCs). If the captured particulate matter is not removed the filter will plug. Combinations of FBCs with other systems provide the most reliable regeneration.

As a general rule, though, particulate traps are only fitted to diesel vehicles over 7.5 tonnes and to vehicles of Euro I, II, III emission standards, although traps for smaller diesel vehicles are now becoming available. Flow-thru filters are another type of filter typically providing 60-75% reduction of particulates.

Engine technologies such as catalytic converters, diesel oxidation catalysts and particulate traps can counteract emission levels

An oxidation catalyst is another system that can be either incorporated into the engine at the design stage of retrofitted later. The system chemically converts hydrocarbons and carbon monoxide into water and carbon dioxide. In western Europe, all new diesel light duty trucks and passenger cars and vans must be fitted with an oxidation catalyst. Results are favourable, reducing up to 90% in carbon monoxide emissions and 90% of hydrocarbons. Particulate matter, however, is reduced by only 20-30%.

Selective catalytic reduction (SCR), meanwhile, is a versatile emission reduction technology that can be used on many types of diesel engine. It is best suited to larger vehicles, due to the need for a small separate tank of chemical reductant. An SCR system has the potential to reduce oxides of NOx emissions by between 50% and 90%, although this will be dependent on the duty cycle as the system is extremely temperature dependent. Some reduction in emissions of particulate matter is also achieved, even if a particulate trap is not fitted.

SCR uses a reductant (ammonia or urea), which is injected into the exhaust gas to help reduce NOx over a catalyst. Some systems also use a particulate trap to further reduce emissions. Unlike some other emissions control equipment, fitting SCR should not result in any increase in fuel consumption and by allowing the engine to be tuned for maximum economy can actually decrease fuel consumption.

Clean Diesel Technologies' ARIS 2000 NOx reduction system is a low-cost urea injection system, which reduces NOx to elemental nitrogen and water vapour. At typical exhaust temperatures of 320-500°C NOx reduction is between 70% and 90%.

The US-based emission reduction specialist Clean Diesel has also developed a new biofuel which it claims can deliver 5% NOx reduction compared to normal on-motorway diesel fuel. Research results based on a Cummins 8.3 litre medium-duty engine, typical of US school buses and delivery fleets, found that a B20 blend mixed with CDT's Platinum Plus fuel-borne catalyst can further reduce emissions.

Steve Howell, technical director of the National Biodiesel Board (NBB) says: 'In most biodiesel testing done so far, NOx is the only emission that biodiesel doesn't reduce. This is a positive development for the industry as we search for ways to reduce NOx emissions in addition to the many other benefits of biodiesel.'

The NBB study also showed a reduction of 23% particulates. 'This blend actually beat a commercial ultra-low sulphur diesel fuel (ULSD) in reducing particulate matter, NOx and carbon dioxide, and was close to the performance of ULSD in reducing hydrocarbon emissions,' says James Valentine, president and COO of CDT.

Although these methods solve the problem of biodiesel NOx emissions indirectly, it has been recommended that engine manufacturers consider the injection timing advancement of their products and plan for biodiesel use. This way there will be no downside to using a domestic, renewable, and cleaner-burning fuel such as biodiesel.

MAN Diesel, a Denmark-based subsidiary of the MAN Group and Finland's Wartsila Corporation, both of which build large, medium and low speed engines for the marine and industrial power plant sectors, is developing engine technologies that use fuel water emulsion injection (FWE) in combination with variable injection timing at part load as the most suitable measure to cut NOx emission.

FWE also has a soot suppressing effect, in particular at part load and low load – a concept confirmed by other engine manufacturers.

If corn is grown at the expense of soya, resulting in the expansion of soya plantations, say in South America, deforestation could result in very large carbon emissions, rendering the gains made from biofuel combustion ineffective.

The environmental oxymoron

There is growing concern that increasing biodiesel feedstock production to offset the carbon footprint made by burning fossil fuels could be counter-productive.

According to a report carried out by 11 civil organisations from around the world, the rush for biofuels is already causing serious ecological and environmental damage. The report finds that biofuels threaten to greatly accelerate climate change through the destruction of ecosystems and carbon sinks on which people depend on for a stable climate.

'There are claims that biofuels will mitigate climate change, yet the reality is very different. The rapid expansion of agrofuel monocultures is speeding up the destruction of peat lands, tropical forests and other ecosystems, leading to massive greenhouse gas emissions. In a worst case scenario, further deforestation for agrofuels could push the Amazon forest into rapid feedback, releasing up to 120 billion tonnes of carbon and disrupting rainfall patterns over much of the northern hemisphere,' says Almuth Ernsting of Biofuelwatch, one of the organisations behind the report.

Positive feedback means that small changes cause the earth's system to produce larger and larger changes, resulting in instability. Negative feedback relates to small changes which cause the system to produce smaller and smaller changes, resulting in the output to the system becoming stabilised.

BiofuelWatch, a UK-based lobby group campaigning against the use of bioenergy from unsustainable sources, argues that although large-scale biofuel expansion could reduce fossil fuel emissions, gains will be wiped out by the associated emissions generated in amassing enough biofeedstocks.

The organisation is concerned that the reduction in greenhouse gas emissions that biofuels cause will be at the expense of a large increase in greenhouse gas emissions from deforestation, other land-use change, NOx emissions, oxidation and potentially the loss of major carbon sinks.

Feedstock feedback

Biofuelwatch claims evidence suggests that a shift to biofuels could greatly accelerate global warming, especially in terms of emissions of NOx and carbon dioxide, due to deforestation and the destruction of peat bogs to make way for biofeedstock crop expansion.

Renton Righelato, microbiologist and consultant on food chain issues to the European Commission, suggests that taking plantation land in Brazil, for example, out of production and allowing for natural forest regeneration would remove 20 tonnes of carbon dioxide per hectare over the next 50-100 years.

Another study finds that carbon dioxide savings compared to equivalent petrol use are 13 tonnes per hectare. This means that, even where no land-use change is involved, soil carbon sequestration from allowing natural vegetation to re-grow would be almost twice as effective for climate change mitigation as using the land for sugarcane ethanol production.

A major concern is the destruction of peatland, especially in Indonesia and Malaysia where 60% of the world's tropical peatlands are found, to make way for palm oil plantations. According to the study, the Indonesian government is planning a 43-fold increase in palm oil production, but research carried out by Wetlands International, Delft Hydraulics and Alterra estimates that one tonne of biodiesel made from palm oil from southeast Asia's peatlands could emit 10-30 tonnes of carbon dioxide in the process.

Biofuel from soya and sugarcane are other environmental oxymorons that wrangle Biofuelwatch. Citing a 2006 NASA study, the lobbyist says that as soya prices increase with the rising use of biofuels, the rate of deforestation will accelerate, flushing the carbon these forests hold to the atmosphere, creating feedback.

The expansion of soya, palm oil and sugarcane, however, is also linked to deforestation in many parts of Asia, Latin America and Africa, with consequences in terms of carbon emissions, loss of carbon sinks, and regional drying and warming trends.

Soya expansion is linked to deforestation in the Pantanal, South America's Atlantic Forest and a portion of the Paranaense forest in Paraguay and north of Argentina. In Argentina, more than 500,000 hectares of forest land were converted to soya plantations between 1998 and 2002.

Sugarcane expansion is impacting on many forests, including the Amazon, the Pantanal, South America's Atlantic Forest, rainforests in Uganda, and in the Philippines; while palm oil is linked to large-scale deforestation in southeast Asia, Colombia, Ecuador, Brazil, Central America, Uganda, Cameroon and elsewhere.

Weighing up the risks

At this stage in the research, associations and commercial organisations are not yet in agreement as to the exact emission levels which come from different fuels and feedstocks. Moreover, debate is still rife as to whether the benefit of these emissions actually outweighs the energy required to cultivate the various raw materials. According to Biofuelwatch: 'Small-scale greenhouse gas savings …do not outweigh the very real risk of triggering environmental feedback in the Amazon and elsewhere, which could cause massive carbon releases, trigger other irreversible climate feedbacks, and potentially disrupt rainfall patterns and thus agriculture over very large areas.'

Industry experts are still debating whether the emissions reductions gained from using biofuels are enough to warrant the destruction of rainforests

Feedstock trends: jatropha

Non-food feedstocks are playing a vital role in the biodiesel market, both for economic and environmental reasons

The period from 2005 until now has experienced unprecedented growth in global biodiesel demand, production, and production capacity. During this time, the increasing demand for traditional feedstocks (rapeseed and soy), and the rise in imports of palm oil from southeast Asia have contributed to a host of new challenges for biodiesel producers. These include sustained high prices for feedstocks, rising demands for alternative, lower cost feedstocks and increased scrutiny from political and consumer groups.

Despite these challenges, the growth of the biodiesel industry in Europe, the US, Asia and Latin America have continued at a rapid pace, and has spawned a variety of new opportunities for developers to meet growing demands for lower cost, non-food, non-rainforest-based feedstocks for biodiesel. These demands are producing new opportunities and stimulating fresh investment in the production of lower cost, alternative feedstocks such as renewable diesel (used vegetable oil, tallow), and high-yield feedstocks such as algae, and jatropha.

While the industry waits for algae and other feedstock contenders to commercialise and address rising demands for biodiesel production, a dramatic increase in the planting of jatropha has been seen in Asia, Africa and Latin America. Jatropha is a large perennial shrub/tree, which produces non-edible seeds that contain 30-40% oil ideal for biodiesel production. One hectare of jatropha can produce between 1.5 – 2.5 tonnes of seed oil.

Since jatropha plants are non-edible and grown in marginal, non-agricultural areas, the growers can produce volumes of plants that are not affected by rising food prices, require little water for cultivation, and do not compete with existing agricultural resources. Jatropha is now emerging as one of the prime contenders for biodiesel feedstock supply in the years ahead.

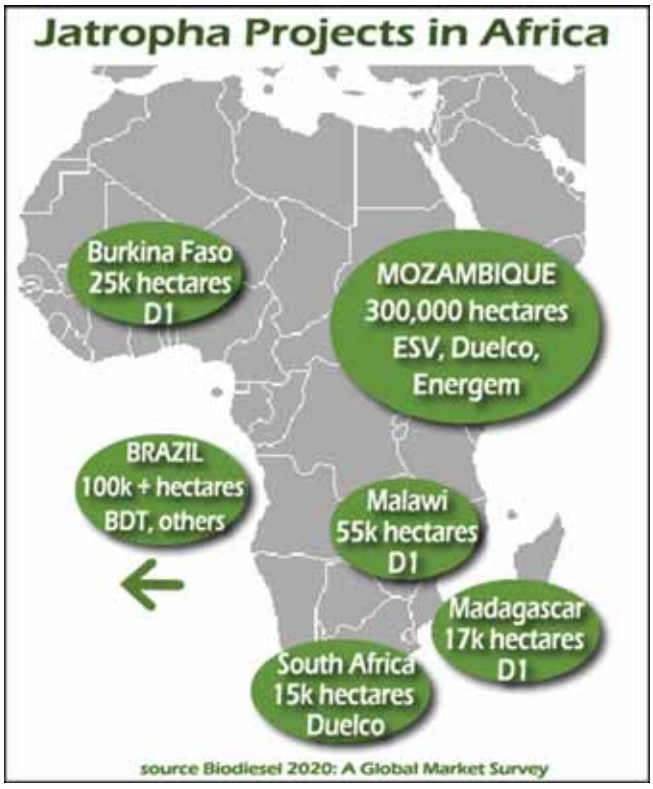
Biodiesel 2020: A Global Market Survey observes three key trends in the jatropha feedstock markets. The first is the expansion of commercial-scale jatropha production from India into Africa, southeast Asia and Latin America. This expansion includes pilot programmes and larger-scale ventures now underway in China, central Asia, central America, and southern parts of the US.

The second trend observed is the participation by governments and energy majors in the cultivation and production of jatropha. The governments of India, Indonesia, Mozambique, Malawi and Brazil have announced major initiatives around large scale jatropha production. An increasing number of private companies such as UK-based BP are establishing partnerships to invest significant capital in medium and large-scale commercial plantations capable of delivering high oil seed yields for biodiesel markets.

The third key trend identified is that jatropha-based projects are being developed as dual purpose entities – one for government programmes, and another for addressing rising global biofuels demands. In the case of government projects, jatropha offers nations the prospect of decreasing petroleum import dependency, while establishing a means for sustainable economic development in rural areas.

In many cases, government projects are supported by larger industry interests for the export of the crop, as a means of economic development within countries, and to alleviate concerns among larger biodiesel consumers worldwide related to elevated feedstock and food prices. Jatropha production is quickly expanding its scope from its nascent stage of community development projects to a larger scope that includes multiple, large-scale commercial projects.

Biodiesel 2020 finds clear signs of progress and intentions to expand hectare production on a global scale. The governments in south Asia and Africa have identified between 20-50 million hectares of suitable land for jatropha cultivation. Since 2005 India has announced plans to develop large scale plantations totalling over 350,000 hectares. During that same time period nearly 300,000 hectares of planned



production projects were established in more than four African nations. Just recently, more than 200,000 hectares of projects were announced in southeast Asia – primarily in Indonesia, Malaysia and the Philippines. India has leveraged its early mover advantage by establishing public-private partnerships and is currently developing large scale plantations with financial commitments to establish over 350,000 hectares. High estimate plans include the cultivation of nearly 2,000,000 hectares by 2012. And India's vision is much larger – various reports have identified over 60 million hectares classified as agricultural wastelands that are suitable for jatropha cultivation.

The entry of energy industry participants and investment in India is helping to provide the investment and technology to enable larger-scale production. Between 2004- 2007 UK-based D1 Oils announced major joint ventures with Mohan Bio Oils, and Williamson Magor, which is one of India's largest tea plantation companies. In July 2007 D1 Oils announced a joint venture with BP and will now begin heavy investments in India-based jatropha production. These partnerships alone could lead to the cultivation of nearly 1,000,000 hectares of jatropha in India by 2012. India has received additional investments from Australia-based Mission Biofuels, and its partnership with Agro Diesel, to manage a 100,000 hectare plantation. Some of this biofuel will likely be used by Mission to serve its Malaysian and Chinese markets.

Outside of India, Africa is now the second largest area of jatropha cultivation, with several commercial-scale plantations under development. Since 2005 several African nations have used private sector investment strategies and are now benefiting from the establishment of larger scale jatropha plantations. The most promising cultivation regions are based in Mozambique, Ghana, Malawi, Tanzania, and Zimbabwe. Mozambique is widely seen as having the largest potential for jatropha production. The International Energy Agency estimated that Mozambique could produce nearly 3 million barrels of oil a day of liquid biofuels from non-food crop resources such as jatropha.

In Mozambique, three significant projects were announced during 2006-2007. Canadian-based Energem Resources has invested $5.5 million (€ 4 million) in its first small plantation with near future commitments to cultivate 60,000 hectares. South African-based Duelco Renewable Energy has established Mozambique partnerships around a 60,000 hectare plantation and ESV-Bio Africa is currently managing an 11,000 hectare plantation with plans for 100,000 hectares.

Ghana is now planning a 12,000 hectare project with South Africa-based BD-1 Group. Ghana has also received interest in jatropha production from Petrobras, Eni SpA, Entaban and Juanx Lioret. In Tanzania, UK-based Sun Biofuels has committed nearly $20 million to jatropha production and a biodiesel processing plant. There are plans for expansion in other African countries as well, including Malawi, Burkina Faso, and Madagascar. Given the increasing support from private sector stakeholders, lower costs of production, and the ideal growing climate, Biodiesel 2020 forecasts long-term, sustained investments and growth in Africa-based jatropha production.

Southeast Asian nations are now working on large-scale jatropha plantations, including Indonesia, Malaysia and the Philippines. Indonesia has identified nearly 23 million hectares of jatropha land potential. Private companies are now investing, including Swedish BioEnergy's $143 million investment in a 100,000 hectare plantation in Indonesia. BP also plans to develop a 100,000 hectare area in Indonesia. Mission Biofuels has also made a significant investment in Malaysia – both in processing plants and jatropha crops. D1 Oils has an operations centre based in the Philippines, and state-owned Philippine National Oil Company has announced plans to construct two biofuel processing facilities with UK-based NRG Chemical. These plans could include cultivation of over 1,000,000 hectares of jatropha.

Apart from the Indian, African, and southeast Asian jatropha projects, the trend in pilot and small scale projects is being initiated in new countries, including China where 650,000 hectares of plantations have been announced for the Yunnan Province. In the US, Florida-based Xenerga will soon begin a pilot project on 5,000 hectares of its patented high octane jatropha line. In Mexico, California-based SE Technology is currently testing a small jatropha pilot project that includes a low-cost mechanical harvest technology intended for cultivation in Mexico and southwest America. Brazil has announced plans for multiple jatropha projects in excess of 100,000 hectares and remains closely involved in supporting projects in Africa.

Jatropha production for biodiesel is likely to enter the mainstream at the beginning of 2008, and will grow in greater volumes from 2010 and beyond. Initial production volumes will start with India, then African and southeast Asian nations, and eventually arrive from Latin American exports. As this occurs, investment and interest will continue from major biofuels investors such as BP, D1 Oils, Duelco, and Mission biofuels, as a long-term commitment to producing lower cost, non-food based crops.

Jatropha projects will serve three key roles – first, to continue as energy crops for local and community projects; second, to contribute a larger role in the national petrol independence programmes of dedicated countries; and finally to supply larger, commercial-scale projects in an effort to supplement the expansion of biodiesel programmes from native countries and growing global biodiesel demands from Europe, the US and Asia.

This article was written by William Thurmond, Emerging Markets Online. The information provided is a series of excerpts from Biodiesel 2020: A Global Market Survey, volume two
www.emerging-markets.com
info@emerging-markets.com

Creating a biofuels roadmap

With such a high level of pressure being placed on the development of biofuels, researchers around the globe are looking at ways of improving and enhancing both new and old technologies

by Brian Davis

Biofuel research is as old as the hills. Back in Roman times people sought to determine the effectiveness of different blends of olive oil for lighting lamps as well as food preparation. Today researchers have somewhat broader ambitions, investigating the building blocks for a new generation of biofuels, chemical intermediates, enzymes, pre-treatment and refining processes, as well as considering socio-economic and environmental implications.

Europe boasts many centres of excellence built around the European Commission's major research programmes termed FP6 and FP7 and other notable projects, and the US is also going from strength to strength.

US research has been stimulated by BP's recent $500 million (€367 million) initiative over the next 10 years to establish a dedicated Energy Biosciences Institute (EBI) attached to the University of California Berkeley with the National Laboratory of Illinois, Urbana-Champaign and the Lawrence Berkeley National Laboratory.

The EBI is designed to foster a new generation of researchers coupling biotechnology and energy production, and will encourage close interaction with leading biotech companies. The initial focus is on renewable fuels from existing and new crop plants. But the EBI will also address allied areas for improved recovery, conversion and carbon sequestration. BP is to deploy about 50 company scientists and technologists on the two US campuses to work with the academics.

A Supergen Bioenergy Consortium researcher

European initiatives

The European Commission recognises the need for a well coordinated strategy for the production of biofuels, but it is a struggle to find a way round the maze of projects within academia, government and private research organisations.

The proposed European Technology Platform for Biofuels should help introduce more clarity for strategy, particularly in the transport sector. EU know-how and scientific excellence is currently dispersed around nation states with widely differing levels of coordination. Given the express aim for significant fossil fuel replacement in accordance with EU Directive 2003/30/EC, and the desire to improve the greenhouse gas balance, European-wide R&D initiatives are likely to gather pace. New initiatives are constantly being introduced with call for interested parties.

An ambitious but reportedly realistic vision for biofuels in the EU was published in March 2006, targeted at meeting 25% of the EU's transport fuel needs by 2030. The report highlights the wide range of biomass resources available in the EU, offering

sustainable and innovative technologies. Experts estimate that over 50 significant biofuel R&D projects are underway, as academic and commercial research organisations work in partnership with industry, biomass providers and biofuel producers to meet the targets. The figure could well be even higher.

The key challenge is to boost the production of biofuels using innovative processes and technologies which make good commercial sense, as well as satisfying increasingly stringent green environmental criteria. Numerous phased developments are underway, based on short-term improvement of existing technologies, together with R&D and commercial development of second generation biofuels (including that from lignocellulosic biomass); development of new energy crops and sustainable agriculture; as well as R&D and implementation of full-scale integrated biorefineries.

There are many alternative options for biofuel and production processes, and the ideal technology has not yet been established. The EU Biofuel Research Advisory Council believes R&D teams need to keep in mind the requirement to deliver competitive, renewable and secure biofuels – without locking into one product or technology today, but creating an environment in which products and technologies can evolve.

Further development is also required for conventional biofuels, with a view to improve the energy and carbon balance of existing technologies, use of innovative feedstocks, new processes for biomass conversion and product fractionation; and advanced modelling methods for process and plant optimisation.

Research teams also need to investigate advanced conversion technologies for second generation biofuels, with particular emphasis on ethanol production from a wider range of resources, including lignocellulosic biomass. Gasification of lignocellulosic biomass is also seen as a promising technology for large-scale production of diesel-type fuels. And biotechnology will help optimise efficient use of energy crops and increase the supply of feedstocks with uniform characteristics to meet major processor demands.

UK

Research programmes in the UK are primarily focused on the improvement of energy crops and conversion technologies. The Supergen Bioenergy Consortium is investigating power generation from biomass using thermo-chemical conversion of vegetable matter, especially crops such as miscanthus, switchgrass and reed canary grass.

This important consortium is managed by Tony Bridgwater of the Aston University Bioenergy Research Group, in partnership with several other universities. There are also four associate academic partners. Industry partners include Alstom, Amec, Bical, Biffa, Biomass Engineering, BP, Coppice Resources, E.ON UK, Johnsson Matthey, Rural Generation and RWE nPower.

The Supergen Bioenergy Consortium recently completed a four-year study and has received a further engineering and physical sciences research council (EPSRC) grant of £6.4 million (€ 9.5 million) to support another four years of research. The EPSRC is the UK government's leading funding agency. The programme covers all steps in the bioenergy chain from production of biomass, breeding and modification of crops, pre-treatment, chemical and thermal conversion, to delivery power, heat and transport fuels. Researchers are examining production of different types of biomass and investigating their behaviour in thermal conversion processes, with emphasis on the interaction and interface between production and conversion. Bioenergy products are also being studied to produce renewable chemicals in a biorefinery, along with the performance, cost and socio-economic benefits of a wide range of bioenergy chains.

Bridgwater led a DTI-backed (now Department for Business Enterprise and Regulatory Reform) mission across Europe in 2006 to study biofuel development programmes, and has produced the authoritative Globalwatch guide to second generation transport fuels, covering the Netherlands, Germany and Finland.

He believes the UK offers a distinct advantage in terms of biofuel research because it integrates all the necessary components to create a viable bioenergy chain, from the field or forest to the power grid or petrol forecourt. However, Bridgwater admits that UK researchers are not carrying out much research into second generation biofuels. 'That's partly because the Supergen programme has been established both for experimentation to build capacity, and also to review available options in a bid to provide strategic direction for further development, demonstration and eventual commercialisation.'

Oxfordshire-based biotechnology company Green Biologics is developing a new way of manufacturing biobutanol with £250,000 backing from the DTI and £310,000 from private investors. Founder and CEO Edward Green claims: 'Biofuels, such as biobutanol, are a sustainable and environmentally friendly next generation fuel that will extend, and ultimately replace fossil fuels.'

Biobutanol is produced from similar feedstocks to ethanol, but has several advantages. It can be easily added to conventional petrol, due to its lower vapour pressure. It is

Miscanthus energy crop

Source: Rothamsted Research

TSEC-BIOSYS develops framework for development of UK bioenergy sector

IMPERIAL COLLEGE London's Centre for Energy Policy and Technology is formulating a roadmap for the development of the UK's bioenergy sector, which could prove a valuable resource. The £2 million programme is funded by the joint Research Councils in line with its Towards a Sustainable Energy Economy strategy. 15 UK partners include 13 academic institutions with links to industry and para-government organisations, including the Carbon Trust.

The TSEC-BIOSYS consortium is using whole system analysis to develop scenarios for future bioenergy demand and supply in the UK, covering heat, power and transport fuel. The consortium will recommend promising research and deployment options; identify bottlenecks and suggest measures to encourage new technology and policy innovation. The TSEC-BIOSYS consortium will also develop biomass resource maps to quantify sources of feedstocks, and develop a sustainability framework.

Interestingly, it promises to develop criteria for assessing the viability of a bioenergy project or scenario. 'In the past, bioenergy has been looked at either from a supply chain viewpoint or as a compartmentalised technology,' says Ausilio Bauen, head of the Imperial College Bioenergy Group. 'The objective of this project is to link supply and demand in a single study, comparing different bioenergy chains in the context of the broader energy sector, the economy and the environment.'

Research teams at Imperial College are also investigating second generation biofuels and the processing of multiple products, including chemicals like polylactic acid, from a single biomass plant. Bauen believes the UK has an edge in a number of areas including catalysis, as well as certain biological degradation and conversion processes.

Imperial College recently set up a significant initiative called the Porter Alliance. The alliance includes leading bioscience research centres including Rothamsted Research, the John Innes Centre and the Institute of Grassland and Environmental Research (IGER), and academic partners Southampton University, Cambridge University and York University.

The Porter Alliance aims to become a one-stop-shop for bioenergy research, focused on sustainability, biomass, cell walls, microbial biotechnology, biorefining, chemicals and material, fuels and combustion, tools and technology. The institutions have invested £4 million in a research programme which will examine every step in the process from the crop to the fuel pump. 'As every step in the process is interdependent, all R&D has to be covered and integrated,' remarks Richard Templer, newly appointed head of the Alliance.

Templer is also eager for the new alliance to participate in an Atlantic Alliance with Oakridge National Laboratories and the Georgia Institute of Technology to facilitate related areas of innovation in renewable and sustainable energy. 60% of the alliance programme is devoted to biomass. Given the recent BP EBI initiative, Templer believes UK universities should also be looking for active participation in the US Department of Energy's (DOE) $500 million programme.

also less susceptible to separation in the presence of water than ethanol, and so has the potential to enter into the industry's existing infrastructure.

Biobutanol is traditionally produced using clostridial fermentation of starch and sugars, in a process first discovered in 1916. Green Biologics is partnering with EKB Technology to develop an advanced fermentation process for butanol, with improved yields and productivity, and to demonstrate lower production costs for its Butafuel product.

BP plans to collaborate with DuPont and British Sugar to produce a biobutanol demonstration facility, using different technology. The plan is to build a 420 million litre plant in Hull to help meet the UK's 2010 Renewable Fuels Obligation. Initially, the biobutanol will be sourced from China for vehicle testing. The pilot plant is due to begin operation in 2009.

In response to the UK Government's biomass task force report, the Forestry Commission set up a Biomass Energy Centre as a hub for bioenergy advice and best practice. The centre offers a compendium of completed and ongoing research.

An Environmental Transformation Fund is also being established to support demonstration and deployment of new environmental technologies including second generation biofuel and biorefinery development. The National Non-Food Crops Centre is also building evidence on costs and benefits of biofuel technologies, working with the industry on feasibility studies to identify commercial opportunities.

Furthermore, the UK supports a collaborative EU approach to new technology development and sustainable production of biofuels, and is involved in the Bioenergy Network of Excellence (NOE) project, the BIOSYS consortium, NILE and other programmes. The UK Energy Research Centre (UKERC) is also examining bioenergy as part of a wider energy research remit.

The University of Southampton is coordinating a € 2.1 million European Cropgen programme to identify energy crops and agro-wastes best suited to energy production in an integrated farming environment. Programme coordinator Charles Banks explains the project will evaluate anaerobic digestion for CH^4 production from energy crops and agricultural residues, as a sustainable fuel source that can be integrated into the existing energy infrastructure in the medium term (10-15 years). He estimates that biogas offers the best overall energy gain from a hectare of land, at 180 gigajoules per hectare.

Finland

Tekes, the Finnish Funding Institute for Technology and Innovation has prioritised the use of liquid biofuels for some time, and is focused mainly on second generation biofuels technology. R&D is organised nationally under the ClimBus technology programme called Promoting business opportunities in mitigating climate change. A new technology programme is also being developed under the working title BioRefine, in a bid to coordinate all Finnish liquid biofuel programmes.

Kai Sipila of Finnish research giant VTT coordinates The NOE project, which covers the entire field of bioenergy technology development, implementation, policy action and market strategy. The NOE programme addresses all processes,

components and strategies necessary for establishing effective bioenergy chains to produce heat, electricity and biofuels. This includes planting and harvesting biomass; analysis of solid fuels from agricultural and forestry residues and organic waste; combustion, gasification and synthesis; pyrolysis, anaerobic digestion and fermentation of biomass feedstock. It also covers the production of liquid biofuels and hydrogen; heat and power production; and analysis of socio-economic policy and environmental issues. The five-year € 8 million programme began in January 2004.

VTT is the largest contract research organisation in northern Europe and has over 2,600 staff. The company uses a Fischer-Tropsch fluidised bed gasification process to handle a range of feedstocks including woody biomass, straw and municipal solid waste. The current development unit is 500Kw, with plans for a commercial scale 200-300MW plant, ideally integrated with energy consuming manufacturing plants, such as paper mills. Neste Oil has expressed interest in building a demonstration plant.

Research is also underway on catalytic gas treatment. VTT has demonstrated fast pyrolysis of biomass to bio-oil to generate unmodified boilers for heat and power using integrated thermal processing. 'The pyrolysis system combines hot sand with biomass to produce a tar-like substance, which can be added to normal crude oil and refined conventionally,' explains VTT research programme manager Niklas von Weymarn. VTT plans to upgrade the biorefinery plant, integrating the front end with current biomass users, and the back end with conventional petrochemical refiners.

VTT is also developing second generation bioethanol, hydrolysing cellulose by enzymes and fermenting the sugars into ethanol using yeast and a variety of feedstocks. The three-phase process involves pre-treatment, working with the University of Lunds, Sweden, NREL in the US, and others. VTT is also studying enzymatic hydrolysis, working with partners in the US, universities across Europe and enzyme producers Novozymes and Genencor.

Experts at Neste Oil believe second generation biofuels offer better fuel quality and lower carbon dioxide. The company is building a € 100 million 170,000 t/y biodiesel plant at the Porvoo refinery to produce NExBTL biofuel, a joint venture with Total. The NExBTL process involves hydrogenation of vegetable oils or animal waste fats to produce pure C_nH_{2n+2} paraffins. Tests with vehicle manufacturer Scania in heavy engines and with VTT for passenger cars show significant reductions in many emissions, particularly particulates, compared with EN590 diesel.

The Netherlands

The Energy Research Centre of the Netherlands, ECN (Energieonderzoek Centrum Nederland) employs about 900 people and has a strong focus on biomass, along with coal and environmental research. Its main area of expertise is production of Fischer-Tropsch diesel via syngas and product gas, formed from low temperature gasification, containing CH^4 and other hydrocarbons as a fuel and (bio)syngas obtained from high temperature gasification and containing only carbon monoxide and hydrogen.

'We believe the major issue is to develop a proper pre-treatment process to make biomass suitable to feed to the gasifier for the Fischer-Tropsch process,' says biofuels programme director Herman den Uil. R&D is focused on the adaptation of the entrained-flow gasification process, with upstream and downstream processing to enable gasification of biomass for Fischer-Tropsch synthesis.

Research is underway of biomass pre-treatment technology (torrefaction) and new feedstock technology, and assessment of the impact of pre-treated biomass on the gasification process. Torrefaction is a mild pyrolysis transforming biomass into a coal-like feedstock, simplifying transportation. ECN is considering using a wide variety of feedstocks including wood residue and other residues from the agricultural industry.

ECN is developing a pre-treatment process to facilitate ethanol production from lignocellulosic biomass, using thermochemical pre-treatment of biomass. A key characteristic of the pre-treatment process is the separation of cellulose, hemicellulose and lignin into separate fractions. ECN is working on the conversion of the lignin fraction into aromatic chemicals.

Researchers are also analysing production of synthetic natural gas (SNG) from biomass. ECN is developing a dedicated gasifier producing a gas rich in CH^4, then upgrading it to natural gas. 'Process steps for gas upgrading have to be fine tuned for processing biomass-derived gas,' says den Uil. The bio-SNG can be used in stationary as well as automotive applications. ECN is also investigating production of chemicals from biomass, working on microalgae cultivation, and carrying out system assessment, design studies and techno-economic evaluations to identify optimum biofuels production routes.

The University of Wageningen Research Centre (WUR) is developing algae for biofuel production using a variety of flat panel reactors. The researchers have also developed a biomass logistics computer simulation (Biologics) and a biomass logistics computer optimisation called Bioloco, which can optimise on

a financial or energetic basis, for examining combinations of transport alternatives.

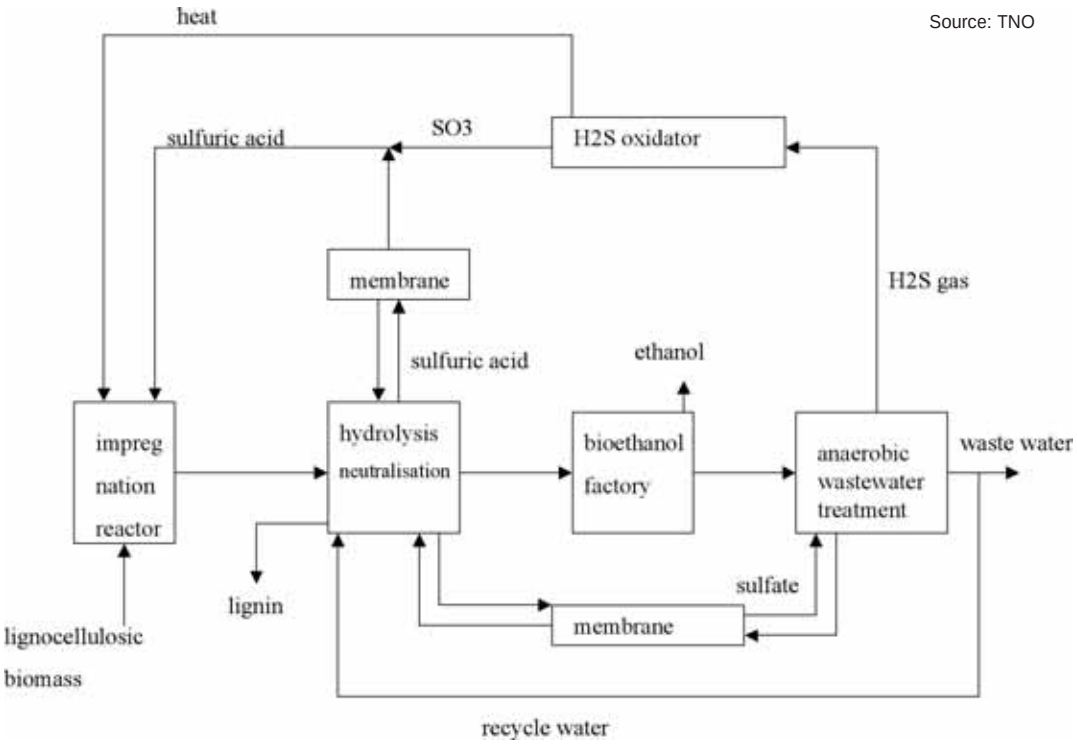
Contract research centre TNO (Netherlands Organisation for Applied Scientific Research) is working on flash pyrolysis of biomass using TNO PyRos technology. A senior researcher Jan Zeevalkink believes that flash pyrolysis can increase the energy density of biomass by a factor of four to five times, decoupling the production and application of pyrolysis oil. The PyRos reactor design is based on a commercial cyclone dust filter operating at 500˚C.

TNO specialises in hydrothermal processing, including supercritical water gasification (SWG) and hydrothermal upgrading (HTU) of biomass, specifically for transport fuels. SWG uses water at high temperature and pressure to yield a hydrogen rich (60%) product gas from aqueous biomass slurry, at typical levels of 10-20% biomass.

Use of supercritical ethanol or methanol can allow transesterification of vegetable oils without using water or lye, to yield clean biodiesel. HTU typically uses 25% biomass in liquid water at 300-355˚C and 120-180 bar, to yield 45% biofuel, 25% gas (>90% carbon dioxide), 20% water and 10% dissolved organics with a thermal efficiency of 70-90%. Shell and Delft University have carried out work on upgrading the biofuel, as a cheaper and more energy efficient alternative to the Fischer-Tropsch process. HTU allows the use of high moisture content organic waste material, like sugar beet pulp and domestic waste, at low or zero cost. Another TNO department is working on the biosulfural process for bioethanol production.

The Biomass Technology Group (BTG) at Enschede is also working on biomass pyrolysis, based on a rotating cone reactor design with a sand heat carrier developed in the early 1990s at the

Source: TNO



Flow sheet of the Biosulfurol process

University of Twente. The system has been upgraded by BTG to give 70% pyrolysis oil, 15% gas and 15% char. BTG is developing a fluidised bed gasifier and a reverse flow tar cracking unit for gas clean up, to allow gasification of biofuel for operation in a gas engine.

Germany

German researchers are highly active in the biofuels arena. Choren Industries, a private research outfit based in Freidberg, has developed three-phase CarboV gasification technology yielding 35% carbon monoxide, 35% hydrogen and 25% carbon dioxide for tar-free syngas. The yield of Fischer-Tropsch liquid fuel is claimed to be to be three to six times more than first generation biodiesel.

Choren Industries is currently working on commercialisation of its biomass-to-liquids (BTL) technology for production of tar-free syngas from biomass via Fischer-Tropsch synthesis. Feedstock is mostly woody biomass. Michael Deutmeyer, head of Choren Biomass says the pilot plant started in 2000 and phase one finished in 2005. The plant is currently being upscaled by a factor of 45 to handle input of 67,000t/y of biomass and will produce 15,000t/y of synthetic fuel. The beta plant is due on stream in 2008. A sigma plant is planned to start operation in 2010/2011 yielding 200,000 t/y of fuel output, equivalent to 1 million tonnes of woody biomass.

Vehicle manufacturer Volkswagen AG coordinates the RENEW (Renewable biofuels for advanced power trains) programme, aimed at producing cost-effective fuels for current and future vehicle combustion engines. Feedstock includes lignocellulosic biomass sources to produce syngas from which a variety of fuels can be derived, including CH^4, H^2, methanol/DME, ethanol (by thermo-chemical and enzymatic pathway) and a novel BTL fuel.

Two pilot-produced (DME and BTL) fuels will be submitted to extensive motor tests by four leading European car manufacturers. Other fuels will be available for tests in complementary European R&D

Choren Biomass beta plant

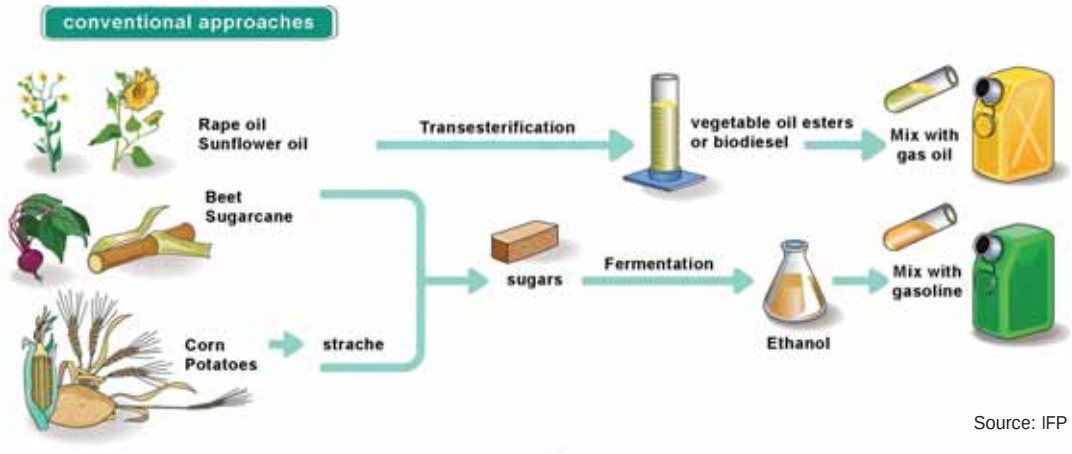
projects. The aim is to introduce favourably priced biomass-derived fuels for motor vehicles from 2010 onwards.

The University of Stuttgart leads BIOASH, an FP6 project looking at ash and aerosol related problems in fixed-bed biomass combustion, pulverised fuel combustion systems and co-firing. The programme is aligned with BIO-PRO which examines new clean combustion techniques, such as flameless oxidation (FLOX) and continuous air staging (COSTAIR) to reduce NOx emissions by 50% and cut CO emissions to <30mg/m^3. Two basic types of BIO-PRO burners are being developed: a pilot burner to burn gases as well as liquids, and a pilot burner to handle gaseous/liquid fuels in combination with solid fuels, applying a pre-gasification step without gas cooling. BIO-PRO is coordinated by TU Graz of Austria.

ZSW of Germany is coordinating the AERGAS II project to develop a biomass fluidised bed gasification process with integrated in-situ gas cleaning for the conversion of biomass into a product gas with high hydrogen concentration, high heating value, low carbon dioxide content, no nitrogen and low tar/alkali/sulphur concentration in one process for subsequent power production.

France

IFP (Institut Francais du Petrole) leads four FP6 programmes, including key research into the production of biofuels including biodiesel (FAME). IFP is exploring biofuel production using catalytic and biological processes as well as gasification. The institute deploys two techniques for conversion of biomass (such as straw, maize stalks and wood waste) using transesterification by homogeneous catalysis or heterogeneous catalysis. 'The work is being carried out in collaboration with INRA and CBRS to create cost-effective solutions which reduce greenhouse gases,' explains Frederic Monot, head of the biotechnology department. IFP has been instrumental in the development of vegetable oil ethyl ester (VOEE) using the Esterfip-HTM process.



Source: IFP

IFP is involved in production of bioethanol from lignocellulosic feedstocks, by biological conversion using pre-treatment, then enzymatic hydrolysis, fermentation, distillation and dehydration. IFP is also studying synthetic fuel production, including BTL, and gasification of feedstocks at high temperature. This phase is being studied in collaboration with the French Atomic Energy Commission CEA.

'We expect to be ready for commercialisation and industrialisation of the first processes by 2015,' says Monot.

IFP coordinates the € 12.5 million NILE programme to determine new improvements for lignocellulosic ethanol via non-thermal pathways. The aim of NILE is to develop more cost-effective production of bioethanol fuel from lignocellulosic biomass, such as agricultural and forestry residues, using enzymatic hydrolysis. The project has three priorities: to develop new enzymes to degrade cellulose in plant materials to sugar, to develop several new strains of yeast to convert all types of sugar to biomass material to ethanol and to improve process integration in order to reduce energy consumption during processing. The technologies will be verified using a fully integrated pilot plant.

IFP has a research centre near Paris and development is carried out near Lyons. The institute also has a process plant at Sete for production of fatty acid methyl esters (FAME) using heterogeneous catalysis in the Esterfip-H process. IFP's industry partners include Axens, Swedish ethanol producer Sekad, Finnish enzyme producer Roal Oy, Sweden's E-Tech and others.

Spain

The Iatur Group set up a pilot plant for biofuel production at Bionorte in 2001 with a production capacity of 4000 t/y, using two different kinds of vegetable oils. The main objectives are recycling and transformation using vegetable oils to produce biodiesel for transport. Iatur is also carrying out R&D and demonstration activities focused on the biofuel production process.

Abengoa Bioenergy leads a € 31 million I+DEA programme for R&D in ethanol for automotive applications in partnership with 25 companies and 29 R&D centres. The express aim is to position Spain as a leader in the fields of bioethanol technology, production and use. The four-year project involves companies from Spain's farming, biofuels, automotive and biotechnology sectors. Abengoa Bioenergy has over 1000 million litres a year installed bioethanol capacity and maintains three production facilities with a capacity of over 500 million litres a year. It is constructing an enzymatic hydrolysis demonstration plant with over 5 million litres a year capacity.

Spanish research outfit Technatom heads the BIOCARD programme to improve the exploitation of the energy crop Cynara Carunculus, under a € 2.5 million programme. Though the crop is considered suitable for Mediterranean areas where there are problems of water sufficiency, early research programmes have not proved very successful. The aim is to produce liquid biofuel from seeds and energy from the lignocellulose.

Portugal

Portugal has also embarked on an ambitious programme of biofuel research including production, conversion processes and related agricultural studies at the University of Coimbra, University of Minho, University of Aveiro, University Nova of Lisbon, University of Lisbon and Technical University of Lisbon, the Institute for Higher Education in Agronomy and INETI, the Research Centre of the Ministry of Economy.

Research covers conversion technologies and gasification using the Fischer-Tropsch processes, analysis of

different raw materials including wastes, and examination of a variety of end-products, including bioethanol, biodiesel and hydrogen. Three demonstration projects are underway in the area of gasification and biodiesel production, each targeting production capacity of about 100,000 t/y.

US

The US is also eager to gain the edge, in a wild bid to soak up all the intellectual property rights it possibly can. President Bush is suddenly a biofuel fan and has pressed the US Department of Energy (DOE) into spending $375 million in a bid to accelerate US biofuel research, and the cellulosic ethanol industry in particular.

The DOE whittled down 20 proposals to three new Bioenergy Research Centres to be located in Oak Ridge, Tennessee, in collaboration with Georgia Institute of Technology, DOE's National Renewable Energy Laboratory, Dartmouth College, and the University of Tennessee Madison. The DOE Great Lakes Bioenergy Research Centre will be led by the University of Wisconsin, in collaboration with Michigan State University.

The new bioenergy research centres aim to boost basic research in development of cellulosic ethanol and other biofuels using regional plants, bringing together teams of researchers from 18 of the nation's leading universities, seven DOE national laboratories, and a range of private organisations.

The DOE's Oakridge National Laboratory (ORNL)-led project, for example, will focus on new methods of processing plants into biofuels, breaking down the lattice of cellulose, hemicellulose and lignin into simple sugars, which can be processed into fuel. The centre will aim to consolidate bioprocessing by use of a single micro-organism or group of organisms to break down plant matter through a one-step conversion process of biomass into biofuels. This is aimed at making cellulosic ethanol cost competitive with petroleum by 2012.

BP's ambitious plan to invest $500 million to establish a dedicated biosciences Energy Biosciences Institute (EBI) at the University of California Berkeley and its partners in the University of Illinois, Urbana-Champaign and the Lawrence Berkeley National Laboratory marks a significant step in BP's commitment to providing lower carbon energy sources, and follows establishment of BP Alternative Energy. The EBI research programme began in July 2007, and will devise new technologies and deploy modern crop science to develop fuels from non-food crops. BP plans to develop multiple integrated bio-refineries using locally produced biomass, and has the benefit of operations in over 100 countries.

The National Renewable Energy Laboratory (NREL) also features an outstanding National Bioenergy Centre which is conducting analyses of the best potential options for large-scale production of chemical intermediates or building blocks from biomass processing platforms. Current work is focused on sugars and syngas. NREL is also evaluating plant-derived oils and oleochemicals in the context of oleochemical biorefineries. A recent study of biodiesel oxidative stability aims to reduce the technical barriers that inhibit broader use of renewable diesel fuels, in accordance with EPA emission standards. NREL researchers are also focused on three basic biochemical conversion technologies: conversion of biomass to sugar or other fermentation feedstock, using dilute acid pre-treatment followed by enzymatic hydrolysis, fermenting these biomass intermediates using biocatalysts, and processing the fermentation product to field fuel-grade ethanol and other fuels, plus chemicals, heat and/or electricity.

Victor Lin, an Iowa State University professor of chemistry is using nanotechnology and chemistry to improve biodiesel production. His aim is to make biodiesel production cheaper, faster and less toxic, along with a cleaner glycol by-product, using the novel process in existing biodiesel plants. Lin has invented a nanosphere-based catalyst that reacts vegetable oils and animal fats with methanol to produce biodiesel, and claims: 'This process could make biodiesel production more economical and environmentally friendly.' Lin is to establish a start-up company to produce, develop and market the biodiesel technology.

Eagle eye view

From a broad prospective, research teams across Europe and the US seem to be addressing all of the big questions in a bid to commercialise a new and existing generation of biofuels as quickly as possible. However, there is still a considerable lack of coordinated strategy, and many institutions will find themselves fighting bitter battles over IP. There is also the question of energy balance and the critical argument of environmental activists worldwide regarding the pros and cons of biofuel versus food production.

Like any new technology, despite being targeted at 800 million drivers worldwide, government and private backing of biofuel research initiatives could well face a rocky road ahead unless a clearly targeted R&D roadmap is drawn up soon, not just nationally but internationally.

2nd Americas *SugarTrade & Ethanol*

12 - 13 November 2007 ■ Radisson Hotel, Miami, USA

Centre for Management Technology ®
Into our 24th year

- NAFTA 2008 & market integration – implications on Sugar/ Sweetener Trade
- Ethanol expansions – extended peak or bubble trouble ?
- Investor/Player's Perpectives in ***Mexico, the Carribean, Costa Rica, El Salvador & Brazil***
- Latest Cellulosic Ethanol Technologies and its impact on Corn-Based Ethanol

- Jenkins Sugar Group
- National Cane Union in Mexico
- Central Motzorongo, SA de CV
- American Sugar Alliance
- Sucden
- Kingsman Societe
- MF Global
- Hencorp Futures, L.C.
- Angostura
- Kinder Morgan
- Cosan
- Ministerio De Agricultura Y Ganaderia (Mag)
- US Dept of Agriculture
- E-Cane Fuel
- Liga Agricola Industrial de la Caña de Azucar (LAICA)
- Nexant, Inc
- USDA
- Michigan State University
- EdenSpace Systems Corporation
- FIMAT

promotion partners

biofuel review
ETHANOLINDIA
INDUSTRIAMBIENTE
Sugar Journal
EthanolMarket.com
SUGARBEET
biofuels international

*Visit us at **www.cmtevents.com** to Register or contact **cynthia@cmtsp.com.sg***

Next Generation Bio-Ethanol

13 - 14 November 2007
SGS Group Headquarters - Geneva, Switzerland

Centre for Management Technology ®
Into our 24th year

"Technical, Economics, Logistics & Enzymes Breakthroughs in Cellulosic Ethanol"

"Can Recent Technologies develop this industry into a competitive level ?"

How You Will Benefit

You will attain a comprehensive grounding in Cellulosic Ethanol Production & Ethanol Blends including

- Cellulosic Ethanol Manufacture, Economics, Technical Aspects
- State of Cellulosic Ethanol Technologies Worldwide.
- Parameters influencing the Economics and Efficiency of Cellulosic ethanol Production from Diverse Crop
- Transportation / Storage of Ethanol & Blending into the Gasoline Pool

promotion partners

biofuel review
ETHANOLINDIA
INDUSTRIAMBIENTE
biofuels international
Sugar Journal
EthanolMarket.com

supported by

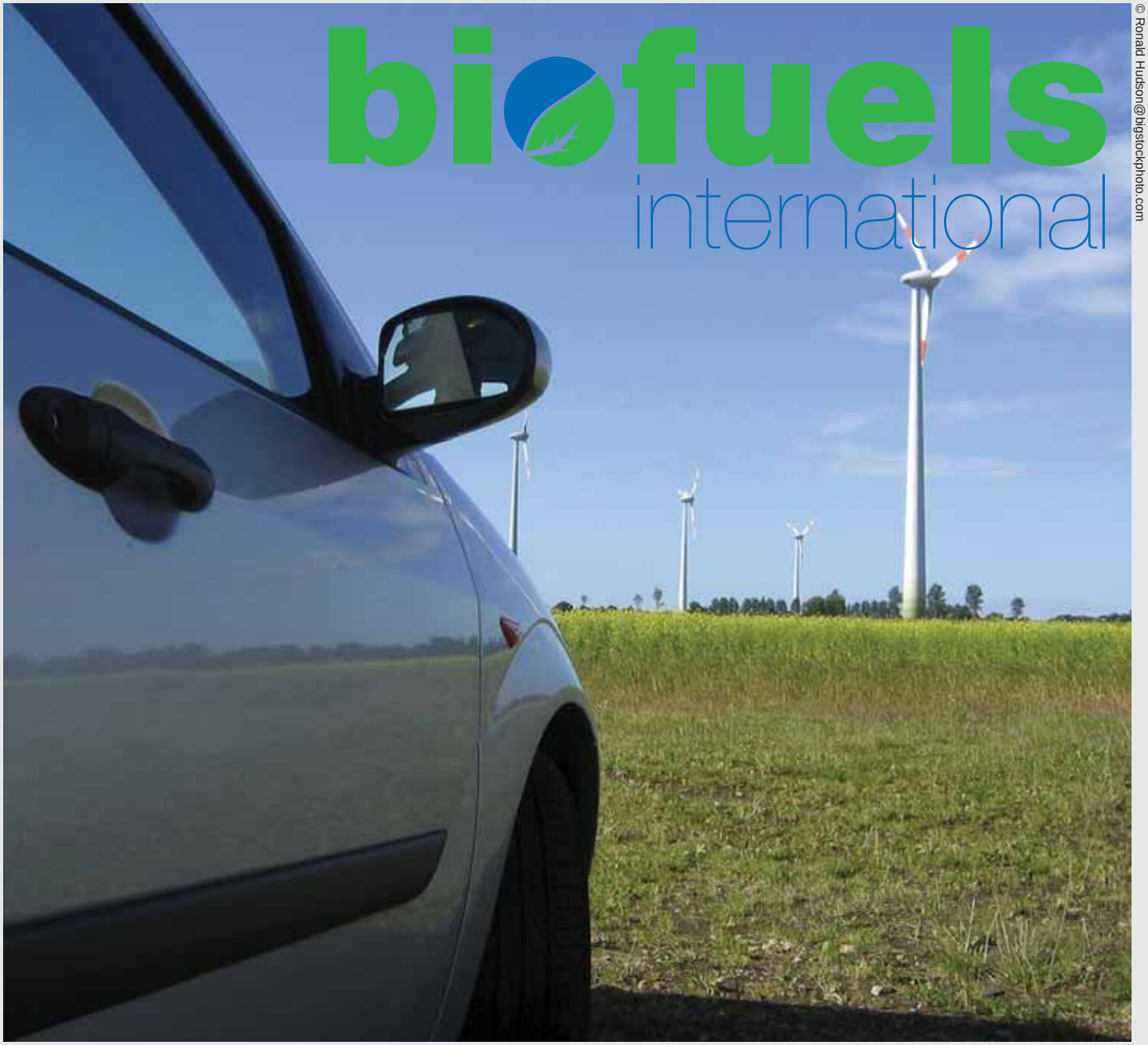
SGS

*Visit us at **www.cmtevents.com** to Register or contact **sasha@cmtsp.com.sg***

Upcoming biofuels events

SEPTEMBER		
25-26	**The Impact of Biofuels on Commodity Markets**	Brussels, Belgium
OCTOBER		
2-3	**StocExpo Asia**	Singapore
4-5	**Next Generation Biofuels Markets**	Amsterdam, the Netherlands
9-11	**BBI Biofuels Workshop & Trade Show – western region**	Oregon, US
15-16	**Platts 2nd Annual Refined Products Storage and Transportation Conference**	Texas, US
16-18	**Platts Cellulosic Ethanol Conference**	Chicago, US
17-18	**Biofuels Finance and Investment**	London, UK
17-18	**Biodiesel Expo**	Newark, UK
18-19	**CIS Biodiesel Congress**	Buenos Aires, Argentina
25-26	**Next Biofuels Technology**	China
25-27	**Expobioenergia Fair 2007**	Valladolid, Spain
29-31	**Biofuels 2007, Vienna**	Austria
30-31	**World Trade Group**	Singapore
NOVEMBER		
5-6	**Biofuels Markets Africa**	Cape Town, South Africa
5-7	**International Congress on Biodiesel**	Vienna, Austria
5-8	**10th World Ethanol 2007**	Amsterdam, the Netherlands
11-13	**Biofuels Asia Conference and Expo**	Singapore
13-14	**A-Z of Ethanol**	Geneva, Switzerland
19-20	**2nd Sugar and Fuel Grade Ethanol/Biodiesel Trade Show**	Miami, US
20-22	**International Trade Fair for the production of Oil and Fats from Renewable Resources**	Munich, Germany
28-30	**BBI Biofuels Workshop & Trade Show – eastern region**	Pennsylvania, US
DECEMBER		
2-4	**4th Annual Canadian Renewable Fuels Summit**	Quebec, Canada
3-5	**Future Fuels 07 Conference**	Washington D.C., US
JANUARY		
9-10	**6th European Motor Biofuels Forum**	Rotterdam, the Netherlands
FEBRUARY		
3-6	**National Biodiesel Conference & Expo 2008**	Florida, US
25-27	**13th Annual National Ethanol Conference**	Florida, US
MARCH		
4-6	**Washington International Renewable Energy Conference**	Washington, US
12-14	**World Biofuels Markets Congress and Exhibition**	Brussels, Belgium
APRIL		
28 -30	**5th Annual World Congress on Industrial Biotechnology and Bioprocessing**	Chicago, US
JULY		
	BioFuels World 2008 Conference & Expo	Yokohama, Japan

advert index



Coming up in the October/November issue of Biofuels International:

Regional focus - South America

Design and plant planning

Esterification and purification

Finance and Investment

Plus all the regular features including regulations, news and a producer profile

biofuels international is published on a bi-monthly basis and designed to appeal to those who wish to learn and be kept abreast of the increasingly important area of biofuels, biodiesel, bioethanol, and biomass.

Want to be kept abreast with industry developments and latest news?
Visit our website at www.biofuels-news.com

Anywhere you need a solution

The Liquid Controls Group is comprised of seven business units in five countries, over 500 distributors on six continents, and six industry leading brands. Combine the knowledge and magnitude of this global network with the precision of their integrated systems, and the Liquid Controls Group can give you mastery over your high-value fluids and gases anywhere in the world you need a solution.

LIQUID CONTROLS GROUP

Toptech Systems, Inc. · CORKEN · LC · SAMPI · SPONSLER · FAURE HERMAN

For more information contact your local distributor or call 800.458.5262 or visit us at www.liquidcontrolsgroup.com

LC07-8