

# biofuels

March/April 2019  
Issue 2 • Volume 13

## international

### **Turbulent times**

**Political instability hinders progress in Europe**

### **An open door policy**

**US ethanol must capitalise on record 2018**

**Regional focus: biofuels in Europe**



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

**MANAGING DIRECTOR**

Peter Patterson  
Tel: +44 (0)208 648 7082  
peter@woodcotemedia.com

**MANAGING EDITOR**

Katie Woodward  
Tel: +44 (0)208 687 4126  
katie@woodcotemedia.com

**EDITOR**

Wael Elazab  
Tel: +44 (0)208 687 4183  
wael@woodcotemedia.com

**JUNIOR EDITOR**

Joshua Heer  
Tel: +44 (0)208 687 4139  
joshua@woodcotemedia.com

**INTERNATIONAL SALES MANAGER**

Edward McCauley  
Tel: +44 (0)203 551 5751  
edward@biofuels-news.com

**US SALES MANAGER**

Matt Weidner  
Tel: +1 610 486 6525  
mtw@weidcom.com

**PRODUCTION**

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

**SUBSCRIPTION RATES**

£170/€235/\$270 for  
6 issues per year  
Contact: Lisa Lee  
Tel: +44 (0)208 687 4160  
Fax: +44 (0)208 687 4130  
marketing@woodcotemedia.com

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ISSN 1754-2170

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Biofuels International, ISSN 1754 - 2170, is published bi-monthly by Woodcote Media Ltd, 124 Middleton Road, Morden, Surrey SM4 6RW, UK.

The US annual subscription price is USD270. Airfreight and mailing in the USA by agent named WN Shipping USA, 156-15, 146th Avenue, 2nd Floor, Jamaica, NY 11434, USA.

Periodicals postage paid at Jamaica NY 11431.

US Postmaster: Send address changes to Biofuels International, WN Shipping USA, 156-15, 146th Avenue, 2nd Floor, Jamaica, NY 11434, USA.

Subscription records are maintained at Woodcote Media Ltd, 124 Middleton Road, Morden, Surrey SM4 6RW, UK.

Air Business Ltd is acting as our mailing agent.

Front cover image: ©Grisha Bruev. Image from bigstockphoto.com

# It's not all doom and gloom

**A**t the end of 2018, the biofuels industry in the European Union (EU) was finally offered some legislative stability, with the final revision of the Renewable Energy Directive (REDII). Member States must now put in place the necessary national legislation in order to move forward in the decarbonisation of the transport sector, with the next few years marking a critical period in the drive to achieve the Paris Agreement climate goals.

For European waste biodiesel producers, secretary general of the European Waste-to-Advanced Biofuels Association (EWABA) Angel Alvarez Alberdi warns that the key issue for the years ahead is feedstock availability, with used cooking oils (UCO) and animal fats limited at 1.7% energy content. Despite being deemed unnecessary by both the European Parliament and Council, the limitation was included in REDII and could impact those producers relying heavily on waste feedstocks.

Staying in the EU (at least for now), in the UK the transport fuels sector lags behind its neighbours on the Continent. Britain has fallen behind on the implementation of E10, with most of the blame directed towards the government and its reluctance to give a positive lead. No doubt minds have been elsewhere in the lead up to the Brexit deadline; at the time of writing, Prime Minister Theresa May had just requested an extension from the EU to 30 June 2019.

Across the Atlantic, policy uncertainty continues to weigh prices, as the US Environmental Protection Agency (EPA) granted yet another small refinery waiver from 2017, bringing the total number of refineries exempt from US biofuel legislation to 35, as of the end of March 2019. These waivers have slashed

around 2.6 billion gallons of biofuel demand from the US market which, together with disruption from flooding across the Midwest, has created what Growth Energy CEO Emily Skor has called a “man-made recession in rural America”.

Ethanol exports from the US however witnessed a record year in 2018, with the US Department of Agriculture (USDA) announcing 1.7 billion gallons in exports, marking the sixth consecutive year of growth for the industry. As Growth Energy's Craig Willis observes in his column in this edition of *Biofuels International*, this trend is “even more remarkable given several new and ongoing trade barriers that limited American producers' and farmers' ability to take full advantage of global ethanol demand.”

As this and other recent developments show, it's not all doom and gloom for the biofuels industry. In Finland, UPM's BioVerno renewable diesel has proven lower particulate and nitrogen oxide emissions in tailpipe testing, which will undoubtedly help the country meet its ambitious climate targets. Innovations and collaborations in the use of biofuels as marine and aviation fuel also abound, with airplane manufacturer Boeing and shipping giant Maersk both announcing recent initiatives.

It's a challenging but exciting time for biofuels, with policy updates in both the US and Europe helping and hindering the industry and producers in equal measure. Make sure you keep track of what's happening on the *Biofuels International* website, with daily updates covering news, legislation and technology developments online at [www.biofuels-news.com](http://www.biofuels-news.com).

**Katie Woodward**  
Managing Editor



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## VTT develops new sustainable option for forest waste

*VTT Technical Research Centre of Finland has developed a new technique that offers a sustainable way to turn forest industry byproducts, such as bark, sawdust and forestry waste, into transport fuels and chemicals.*

The new technique uses gasification to turn biomass into intermediate products, such as liquid hydrocarbons, methanol or methane, in production units integrated with communal district heating plants or forest industry power

plants. The intermediate products are then processed in oil refineries to make renewable fuels or chemicals.

VTT has developed and piloted the new gasification process. The process is based on VTT's low-pressure, low-temperature steam gasification technology, simplified gas purification and small-scale industrial syntheses.

Senior principal scientist Esa Kurkela said: "Not one of the large gasification plants of more than 300MW that have been planned for Europe has been built yet. The almost €1 billion investment needed together with the risks associated with new technology has



proven an insurmountable obstacle. The smaller scale of our solutions makes it easier to secure funding for building the first plant based on the new technology."

The new technology is set to become considerably more competitive as the costs of the raw material of competing technologies increase, and the process is expected to be highly competitive at least

from the year 2030 onwards.

The gasification technology development is set to continue through two EU Horizon 2020 projects coordinated by VTT. The projects will focus on gas purification and increasing the efficiency of synthesis technology and aim to demonstrate the performance of the entire biofuel chain at VTT's Bioruukkii piloting centre in Espoo, Finland. ●

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## Neste opens commercial renewable diesel fuel station in California

*Renewable diesel producer Neste has opened its first cardlock in San Leandro, California that will offer the company's MY Renewable Diesel.*

The milestone marks the first time that vehicles can fuel up with Neste's renewable diesel, made from sustainable biomass, directly at a station. Cardlocks are unstaffed fuelling stations designed to accommodate fleet vehicles, such as large trucks.

"Since launching in California in 2017, we've had a lot of positive feedback from drivers and fleet managers using Neste MY Renewable Diesel," said Jeremy Baines, vice-president of sales at Neste. "And those who haven't tried it yet keep asking where they can get it. We're proud to offer Neste MY Renewable Diesel at these cardlock locations to further expand its accessibility and lead the renewable fuel revolution."

The company plans to open three other sites across California, with each able to supply its renewable, low-carbon diesel fuel, produced from 100% renewable and sustainable biomass. According to Neste, the fuel reduces greenhouse gases by up to 80% compared to petroleum diesel.

Baines added: "Demand for cleaner fuels is on the rise globally, and California is a leader in the movement toward an emission-free future. Neste MY Renewable Diesel helps meet environmental needs without compromising performance."

The renewable fuel is a direct replacement for petroleum diesel and does not require blending. It is compatible with all diesel engines, with no modifications required. ●

## Letter calls for extension of biodiesel tax incentive

*A letter has been sent to US Congress about a multi-year extension of the biodiesel tax incentive.*

The letter was written by 44 members of the House of Representatives and stated that after letting the biodiesel tax incentive for 2017 expire for 2018 and beyond, "the industry is once again facing prolonged uncertainty about this policy."

The bipartisan coalition of House members was led by representatives, Dave Loebsack, D-Iowa and Darin LaHood, R-Ill. They wrote: "Biodiesel has been and continues to be a great American success story. Biodiesel production supports more than 60,000 good paying jobs in the US and helps rural communities across the country

build new economic opportunities."

The members of House of Representatives also wrote that the expansion would "deliver economic and environmental benefits to drivers, consumers, farmers and others all along the value chain."

Kurt Kovarik, vice-president of federal affairs for the National Biodiesel Board (NBB) said in the letter: "NBB and its members appreciate the leadership of Representatives Loebsack, LaHood and others from across the country who co-signed this letter."

Kovarik continued: "The letter demonstrates the strong, bipartisan support for a multi-year extension of the biodiesel tax incentive now, in order to provide biodiesel producers, blenders and retailers the opportunity to plan and expand the market for biodiesel. ●



# Study finds biofuels contribute \$5 billion to Iowa's GDP

A recent study commissioned by the Iowa Renewable Fuels Association (IRFA) has found that biofuels contribute over \$5 billion (€4.38 million) to Iowa's GDP, equivalent to 3%.

The 'Contribution of the renewable fuels industry to the economy of Iowa' report, authored by John Urbanchuck, managing partner at ABF Economics, revealed that the biofuels industry supports over 48,000 jobs in the state and adds more than \$2.5 billion (€2.19 million) to household incomes.

"The results of this study serve as a great reminder to our state and federal representatives that biofuels continue to be a smart and profitable investment for Iowa," said IRFA executive director Monte Shaw.

"As this industry grows, so do the

economic opportunities for our state. However, actions being taken on the federal level, such as the continued use of small refinery exemptions (SREs) by the US Environmental Protection Agency (EPA) that undermine the Renewable Fuel Standard (RFS), can jeopardise the future of Iowa biofuel producers and the many economic benefits they provide for Iowa."

In addition to offering crucial support to agriculture and rural economies in the US state, the report warned that fair and stable policy is needed to maximise potential benefits from biofuels.

"Uncertainty surrounding issues like SREs, tax credit extensions, trade with China, year-around E15 sales, and the RFS reset will impede the ability of the industry to provide these societal benefits," the report noted.

IRFA members met with state legislators on 20 March to promote the results of the study and encourage representatives to

continue to support the biofuels industry with favourable policy decisions.

"Iowa farmers and biofuel producers are suffering from low prices, and we desperately need a strong RFS and extended biodiesel tax credit," Shaw added. "The message to our representatives here in Iowa and Washington is if they turn their backs on the policies that have helped grow biofuels, billions of dollars in economic activity and tens of thousands of jobs will be jeopardised." ●



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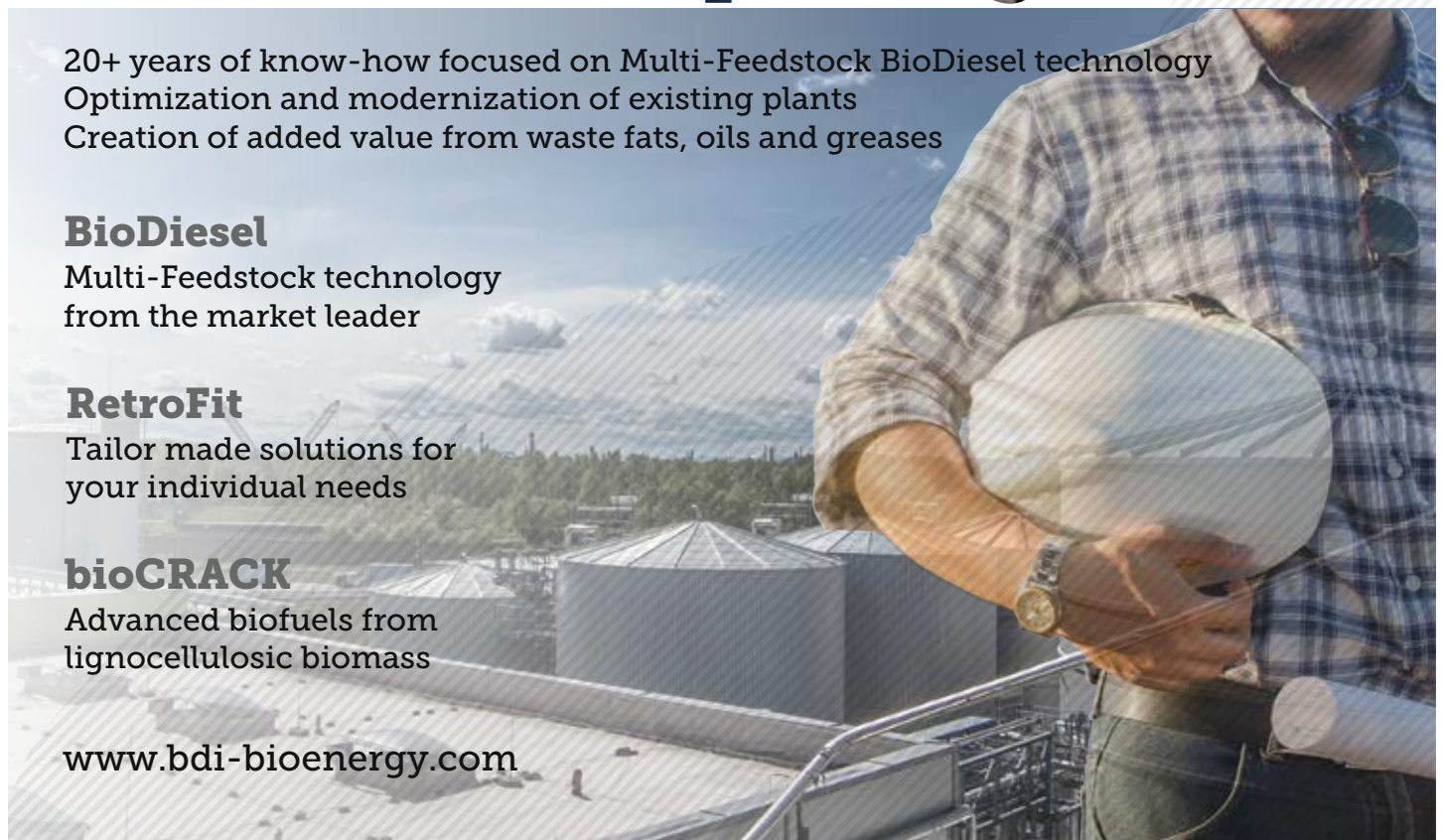
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## Inquiry launched into E10 in the UK

*The All Party Parliamentary Group for British Bioethanol (APPG for British Bioethanol) announced that it has launched an inquiry into introducing E10 into the UK.*

“The British bioethanol industry – which is worth a billion pounds to the UK economy – is in a state of collapse and the introduction of E10 could help bring it back from the brink. This inquiry will seek to better understand the issues and barriers around introducing E10 in the UK which is already available in many other developed nations,” said chair of the APPG for British Bioethanol and Scunthorpe MP Nic Dakin.

“While securing the future of the industry on which thousands of jobs depend, introducing E10 could also help the UK meet its carbon reduction and air quality improvement targets, making it an issue urgently needing further investigation.”

This inquiry follows announcements last year from two of the UK’s largest bioethanol producers, Vivergo and Ensus, of their plans to cease and pause production.

In September, Vivergo cited the lack of legislation incentives as the reason for its plant closure. Only a 5% blend of ethanol mix (E5) is currently available in the UK.

“After years of delay and false dawns, the bioethanol industry now needs urgent progress on



E10 which if introduced, could bring this one billion pound industry back from the brink of collapse,” said Grant Pearson, commercial director at Ensus Fuels.

“As E10 is cleaner and

greener than the current E5 fuel, making it available at UK pumps is a no brainer, but we hope this inquiry will identify any remaining barriers to its introduction and ways to quickly overcome them.” ●

## Toyota to launch yeast strains for US cellulosic ethanol

*Lallemand Biofuels & Distilled Spirits (LBDS), the renewables division of Canadian firm Lallemand, announced that it has signed an agreement with car manufacturer Toyota.*

The agreement regards the production and marketing of Toyota’s XyloAce yeast strains for cellulosic ethanol production in the US.

Lallemand describes XyloAce as ‘highly efficient’ at fermenting xylose and arabinose, while also being highly resistant to fermentation-inhibiting substances such as acetic acid. Lallemand continues to claim that the strains have achieved some of the highest ethanol fermentation density levels in the world.

“Adding the Toyota



XyloAce product line to our portfolio will allow our customers to choose from the very best cellulosic yeast

strains available,” said LBDS president Angus Ballard.

“We are proud to be working with Toyota and

look forward to driving increased profitability for cellulosic ethanol producers throughout North America.” ●

## Boeing to launch biofuels initiative for return flights

*Airplane manufacturer Boeing announced that it will be offering airlines and operators the option of powering their new commercial jets with biofuel for return flights.*

Boeing claims that the initiative supports the industry's drive to protect the environment, lowering emissions by up to 80%.

"This is another step in our decade-long journey to encourage the adoption of sustainable fuels and help commercial aviation earn its license to keep growing," said Sheila Remes, vice-president of strategy at Boeing Commercial Airplanes.

"We have great customers such as Alaska Airlines that have made good progress in adopting the use of biofuels. We hope this new option will make it easier for them and others to demonstrate our industry's commitment to reduce carbon emissions."

Alaska Airlines will be utilising a blend of biofuel from Boston-headquartered World Energy and traditional aviation fuel when it accepts a delivery of three Boeing 737 Max planes.

"Alaska takes seriously the responsibility to deliver for all those who depend on us – employees,

guests, our communities and the environment around us – for the long term. That's the definition of sustainability," said Diana Birkett Rakow, vice-president of external relations at Alaska Airlines.

"We congratulate our partners at Boeing for operationalising a drop-in sustainable aviation jet fuel option. We're excited to not only take advantage of the first biofuel delivery, but to continue working together to advance and scale mainstream adoption of sustainable fuel and other practices to enhance the aviation industry's ability to do good."

World Energy produces the biofuel at its refinery in Paramount, California, which Boeing claims is the world's first facility designed to commercially produce renewable jet fuel.

"World Energy is here to serve any organization committed to leading the shift toward a low-carbon future," World Energy CCO Bryan Sherbacow said.

"Companies such as Boeing understand their obligation to the communities they serve and have taken meaningful action to transition to cleaner energy and reduce their carbon footprint. Our job is to manage the low-carbon fuel supply chain to provide the product these leaders need to efficiently operate and drive positive change." ●

## Gulfstream makes first sale of sustainable alternative jet fuel

*Gulfstream Aerospace has made its first sale of sustainable alternative jet fuel (SAJF) to a US-based Gulfstream operator.*

The customer bought 20,000 pounds (9.07 tonnes) of Gulfstream's bio-jet fuel from its facility in Long Beach, California for its Gulfstream G550 aircraft.

"This sale is a direct result of our efforts to increase the visibility and availability of sustainable alternative jet fuel for our customers," said Mark Burns, president of Gulfstream Aerospace.

"We are committed to helping promote increased use of SAJF throughout the industry. We've been using the fuel since 2016 with our corporate, demonstration and Flight Test fleets, and we're now proud to offer it to operators as well. We look forward to the day this fuel is commonplace in our industry and we are all doing our part to reduce emissions worldwide."

Since 2012, the company has been using a blend of 30/70 low-carbon, drop-in SAJF and Jet-A fuel in operations at its headquarters in Savannah. The bio-jet fuel is produced at World Energy's refinery, located near Long Beach Airport.

The US Federal Aviation Administration has confirmed that SAJF is safe to use. Throughout its lifecycle, the fuel achieves more than a 50% reduction in greenhouse gas emissions per gallon, compared to petroleum-based jet fuel.

Gulfstream also announced that it will start using SAJF on large-cabin aircraft flights from Long Beach Airport in the near future. ●

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## Key Topics

Evaluating Further Developments Of Key Policies Impacting On Oleofuels Supply Chain

Exploring Oleofuels Industry' Response To The Renewable Energy Directive II (RED II), Annex IXa

In Depth Analysis of Hydrotreated Vegetable Oil (HVO) Production Status & Future Development Plans

Biofuels As A Part Of Further Decarbonisation Strategy: Evaluating Future Applications In Heavy Duty Vehicles & Shipping Industry

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# Maersk, Dutch partners launch world's largest maritime biofuel pilot

Members of the Dutch Sustainable Growth Coalition (DSGC) have partnered with A. P. Moller – Maersk on the world's largest maritime biofuel project.

Dutch companies FrieslandCampina, Heineken, Philips, DSM, Shell and Unilever will work with Maersk on a pilot, which will use up to 20% sustainable second-generation biofuels to power a triple-E ocean vessel.

According to the project partners, the vessel will sail the 25,000-nautical mile roundtrip from Rotterdam to Shanghai solely on biofuel blends. Using this sustainable fuel, produced from waste cooking oil, will save 1.5 million kilograms of carbon dioxide



(CO<sub>2</sub>) and 20,000 kilograms of sulphur.

Speaking about the importance of decarbonising ocean shipping, Jan Peter Balkenende, chair of the DSGC, said: "This pilot testing biofuel on a cross ocean shipping lane marks an

important step. However, many more innovations are urgently needed. These can only be successfully developed, tested and implemented in industry collaborations like this."

Søren Toft, COO at A. P. Moller – Maersk, added: "To reach our net zero CO<sub>2</sub> target by 2050, in the next 10 years we need big breakthroughs. Maersk cannot do this alone. That is why this collaboration with DSGC and its members is such an important step in identifying and bringing low carbon solutions to life."

The DSCG members initiated and are sponsoring the pilot, while Shell will supply fuel and Maersk will act as operating partner.

The roundtrip voyage will take place between March and June this year. ●

## incident report

*A summary of the recent explosions, fires and leaks in the biofuels industry*

Date	Location	Company	Incident information
25/03/19	North Karachi, Pakistan	Madina CNG	Two people died and four were injured when an explosion took place at the Madina CNG fuel station. The deceased include the station owner and an employee. The incident was deemed an accident by a bomb disposal squad. Sui Southern Gas Company immediately suspended CNG supply to the station following the explosion, which occurred in a store room at the site. The cause of the explosion has yet to be confirmed.
21/03/19	Brevard County, Florida, US	N/A	A tanker spilled more than 7,000 gallons of biodiesel on the Interstate 95, after the driver became distracted and lost control of the tanker. The spill forced the closure of southbound lanes on the Interstate 95 at the Fiske Boulevard interchange. The driver received minor injuries, and no other vehicles were involved.
20/02/19	Fairbank, Iowa, US	Flint Hills Resources	A fire damaged a silo at an ethanol plant in rural Fayette County. Firefighters from Fairbank, Westgate, Independence and Waverly were called to the scene. According to the Buchanan County Sheriff's Office there was no risk of an explosion. No injuries were reported.

# Plant update: Europe

## Vivergo

<b>Location</b>	Hull, UK
<b>Date</b>	September 2018
<b>Development</b>	Closure
<b>Alternative fuel</b>	Bioethanol
<b>Details</b>	Formed in 2007, Vivergo aimed to deliver a substantial and significant portion of the UK's forecast biofuel demand. Originally a joint venture between AB Sugar and Du Pont, the company set out to become a biorefinery for the future. However, on the 6th of September it announced its proposal to cease production.
<b>Comments</b>	"I am extremely disappointed at having to announce the proposed cessation of production as of the 30th of September 2018. We have created a highly skilled and world-class business that had the opportunity to be part of a British sustainable biofuels industry. But sadly, the Government's lack of pace over the past decade to introduce E10 has further undermined our ability to operate."



## CropEnergies

<b>Location</b>	Wilton, UK
<b>Date</b>	February 2019
<b>Development</b>	Resuming production
<b>Alternative fuel</b>	Bioethanol
<b>Details</b>	German ethanol producer CropEnergies revealed that in a board meeting the company decided to resume ethanol production at its UK plant in Wilton at the beginning of March 2019. However, CropEnergies noted that for there to be continuous operation at the Wilton facility, changes in UK legislation would need to be made, primarily the introduction of a 10% ethanol blend (E10).
<b>Comments</b>	"Already today, climate friendly Premium E10 is the standard fuel for the certification of new petrol engines in the EU."

## Total

<b>Location</b>	Châteauneuf-les-Martigues, France
<b>Date</b>	October 2018
<b>Development</b>	Delay of launch
<b>Alternative fuel</b>	Biodiesel
<b>Details</b>	French oil & gas firm Total has chosen to delay its planned biodiesel refinery, named La Mede, until the first quarter of 2019. The refinery is estimated to have a capacity of 500,000 tonnes of biodiesel. Originally scheduled to start in the summer of 2018, the refinery has cost Total upwards of €200 million. The planned refinery has been met with opposition after France's largest union had called for a nationwide blockade in response to the facility's intended use of imported palm oil. Despite this, the project is set to be coupled with a plan for continuous improvement of the company's energy efficiency, with the objective of reducing energy consumption by 8% before 2020.

## Greenergy

<b>Location</b>	Amsterdam, the Netherlands
<b>Date</b>	July 2018
<b>Development</b>	Acquisition
<b>Alternative fuel</b>	Biodiesel
<b>Details</b>	Greenergy has reached an agreement with Oiltanking, a tank terminal operator, to purchase an idle biodiesel manufacturing facility located at Oiltanking's site in Amsterdam. The acquisition of a third biodiesel plant will allow Greenergy to meet growing demand for waste-based biofuel in the UK and Europe. The Amsterdam biodiesel manufacturing facility was built in 2010 to process vegetable oils but was never commissioned. Greenergy plans to carry out works over the next year to convert the facility to process waste oils rather than vegetable oils and then to add further production capacity.
<b>Comments</b>	"Demand for waste-based biodiesel is rising rapidly in the UK and Europe as a result of higher obligated biofuel inclusion rates. Over the last few years we have scaled up our raw material supply chains and invested in our UK manufacturing facilities, increasing output through a variety of incremental investments. We are now leveraging these skills and capabilities to develop a third plant."

\*This list is based on information made available to *Biofuels International* at the time of printing. If you would like to update the list with any additional plant information for future issues, please email [katie@woodcotemedia.com](mailto:katie@woodcotemedia.com)

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#### Melanie Little

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*Senior Vice President, Operations and Environmental, Health, Safety & Security*



Industry leader Melanie Little opens our conference with a presentation on improving performance using strategy, outcomes and goals. While most companies have a written strategy, team members often fail to understand

how the strategy ties into their jobs. Little will share lessons and demonstrate how having a clear strategy can ensure alignment across all functional areas and bolster team morale. Attendees will learn how a clear strategy can provide a platform for senior leaders to develop and communicate key outcomes and ensure that resources are truly focused in areas that will provide the best chance of achieving the company's success.

### Re-thinking Risk

#### Jordy Hendrixx

Montana State University  
*Director of the Snow and Avalanche Lab, Associate Professor of Geography*



During lunch on Monday, scientist Jordy Hendrixx will ask us to re-think risk by looking at lessons learned in other hazardous settings—namely avalanche-prone areas. Bridging his decades of research on avalanche

fatalities with his knowledge of risk management, Hendrixx will demonstrate how focusing on human-dimensions and decision making can help reduce fatalities and injuries in any risky setting. Hendrixx has spent the last 20 years working on snow and avalanche projects in mountains around the world, from Antarctica to the Arctic. His work has been featured by *Nature*, *The Wall Street Journal*, *The New York Times* and *Powder Magazine*.

### Traits of Successful Leaders

#### Walter Nusbaum

President, The Nusbaum Group  
*Author, Do You Have What It Takes? and The Sink: Radical Transformation with One Small Change*



The conference concludes with a presentation from author Walter Nusbaum. Building on themes from his books, *Do You Have What It Takes?* and *The Sink: Radical Transformation with One Small Change*, Nusbaum will examine the seven critical

traits of successful leaders and teams and show how success can be accomplished by anyone willing to do the work. Nusbaum will challenge everyone to evaluate themselves, and he will discuss how they can continue to develop each of the seven critical elements of success. Walter's academic background in strategic management, leadership and philosophy, along with his ability to see the problem and provide proven solutions, has made him a highly sought-after speaker and coach.

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# The post-REDII waste biodiesel conundrum

By Angel Alvarez Alberdi, secretary general of EWABA

With the entry into force of the revision of the renewable energy directive (REDII) in December 2018, following months of intense negotiations, the European Union (EU) biofuels industry at large entered a no less important phase in which Member States have to put in place the necessary national REDII implementing legislation ahead of the 31 June 2021 transposition deadline. The REDII gives plenty of margin for Member States to legislate on decarbonising the transport sector, and given that biofuels rely on public support, producers and interested stakeholders should closely follow the actions of their respective national officials. A first indication of what lies ahead can be found in the draft national energy and climate plans from Member States, recently published by the European Commission.<sup>1</sup>

From the perspective of the European waste biodiesel producers, the key issue in the years to come is feedstock availability, a sensitive matter affecting different to-be-implemented REDII provisions, in particular the following two.

## Dealing with the flexible REDII limitation to certain waste feedstocks

The use of waste feedstocks in Part B of Annex IX of the REDII (used cooking oils (UCO) and

animal fats) is limited at 1.7% energy content (3.4% in Member States applying double counting). This limitation was justified upon the basis of a global limitation of waste “by nature” and was deemed to be unnecessary by both the European Parliament and Council, which eliminated it in their preparatory documents during REDII negotiations. The limitation eventually came back to the law-making table due to the reintroduction of the double counting mechanism for UCO and animal fats, a classic example of legislative horse-trading. Even so, EU legislators, aware of its inherent harmfulness and lack of justification, gave Member States the option to modify the limitation taking into consideration feedstock availability and with the consent of the European Commission. National waste biodiesel producers will have the respite of not being forced to face the damages of market contractions in waste markets relying heavily on waste feedstocks.

## Indiscriminate incentives for aviation are dangerous

The REDII allows Member States to implement a x1.2 multiplier for aviation (x2.4 in Member States applying double counting). In addition, some Member States are considering introducing specific incorporation obligations



for renewable aviation fuels.

Out of the existing five accepted technologies for alternative aviation fuels,<sup>2</sup> only one is being produced in large commercial quantities: HEFA-SPK (hydro-processed esters and fatty acids–synthetic paraffinic kerosene). The possible feedstocks that this technology can use are pure vegetable oils, UCO and animal fats. The REDII excludes crop-based biofuels from aviation incentives, therefore only waste feedstocks from Part B of Annex IX (UCO and animal fats) are left for aviation.

Waste biodiesel types such as used cooking oil methyl ester (UCOME) and tallow methyl ester (TME) cannot be used as jet fuel due to their cold flow properties. For this reason, the indiscriminate promotion of alternative fuels in aviation breaks the principle of technology neutrality, as it promotes the hydro-treating technology against the transesterification of waste oils and animal fats. In other words, the promotion of aviation fuels would be made at the expense of sustainable biofuels for the road transport sector.

Indiscriminate aviation incentives would unlevel the playing field and give a few large hydro-treated vegetable oil (HVO) refineries an unfair advantage over a far more numerous network of waste biodiesel producers. HVO refineries with deeper pockets and additional public support will be able to outbuy the same waste feedstock used by waste biodiesel producers and very quickly drive them out of the market. This would not only have negative consequences for Member States wishing to decarbonise the road transport sector and waste biodiesel producers, but it would also negatively affect greenhouse gas (GHG) reduction as a whole, given that, as established in Annex V of the REDII, UCOME and TME have higher GHG savings than any form of HVO or hydro-treated alternative fuels, the production of which is energy-intensive and costly.

These unintended consequences of the highly fashionable incentives for alternative fuels in aviation are starting to be picked up by NGOs, which warn of the unsustainable consequences of diverting UCO and animal fats from road biodiesel into aviation HVO,<sup>3</sup> and notably by the International Energy Agency (IEA) itself. In a recent analysis<sup>4</sup> the IEA calls for increasing research and development in novel advanced aviation biofuels using agricultural residues and municipal solid wastes, which are more widely available and less expensive than waste

oils and animal fats. In the future, the IEA promotes the concept of producing synthetic fuels using renewable electricity, carbon dioxide and water as a feedstock.

Indiscriminate promotion of aviation fuels will not result in the much-needed research and investment in these promising cutting-edge technologies; instead it will harm the well-established waste biodiesel industry, destroying employment and reducing global GHG mitigation. One of the Member States relying heavily on waste biodiesel from UCO and animal fats for the decarbonisation of the road transport sector, the UK, understood in advance the hidden risks associated with aviation incentives and plainly excluded UCO

and animal fats from aviation incentives in the development fuels category. The EU waste biodiesel industry advocates for many other national authorities to follow the British example. ●

**Footnotes**

1. National Energy and Climate Plans (NECPs), <https://ec.europa.eu/energy/en/topics/energy-strategy-and-energy-union/governance-energy-union/national-energy-climate-plans>
2. ASTM Certified Conversion Processes, <https://www.icao.int/environmental-protection/GFAAF/Pages/Facts-Figures.aspx>
3. 'How green and scalable are the aviation biofuels that United Airlines and Oslo Airport source from world energy?', <https://www.biofuelwatch.org.uk/wp-content/uploads/WorldEnergy-biofuels-briefing.pdf>
4. 'Commentary: Are aviation biofuels ready for take off?', <https://www.iea.org/newsroom/news/2019/march/are-aviation-biofuels-ready-for-take-off.html>



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Scott Fenwick

# Biodiesel drives the US work truck industry

**By Scott Fenwick, technical director at the National Biodiesel Board**

**A**s the future of the transportation industry continues to evolve, there is one thing we know for sure; work needs to be done. Multiple studies show that diesel engines will continue to be the industry's preferred workhorses for many years to come. And biodiesel, America's Advanced Biofuel, has an important role to play.

The future of the US biodiesel industry is bright, with new research by NTEA (the Association for the Work Truck Industry) confirming that fleets across North America increasingly rely on the power and performance of biodiesel to get the job done. For the third time in four years, surveyed fleets named biodiesel as their top alternative fuel choice for current use and future interest.

Each year, NTEA conducts a comprehensive Fleet Purchasing Outlook Survey to better understand the commercial vehicle landscape, including interest levels for advanced truck technologies and alternative fuels. The 2019 survey revealed that the 76% majority of fleet respondents anticipate maintaining or increasing use of diesel engine-powered trucks in their fleets, and more than 33% of survey respondents acknowledged currently operating alternative fuelled trucks in their fleets.

There was even more good news for the industry when survey participants named biodiesel as their top alternative fuel choice, at 16%, and their top choice for future interest, at 14%. Additional anecdotal evidence from the NTEA suggests that though alternative fuel interest may ebb and flow along with fluctuating oil prices, the trend will likely turn upward in the long run. It is highly likely that clean energy solutions will remain relevant due to oil price instability. We further credit the national growing interest in reducing carbon

and greenhouse gas emissions from the transportation sector as positive indicators for future use of biodiesel.

Because biodiesel blends can be used in any diesel engine without modification, according to manufacturers' recommendations, they offer fleets an easy and cost-effective way to reduce their carbon footprint in existing diesel vehicle fleets. Customers from coast to coast have successfully used B20, a blend of 20% biodiesel with 80% ultra-low sulphur diesel, in virtually every make and model diesel engine, and the vast majority of new diesel engines now have full OEM support for B20 meeting current ASTM specifications. Compared to fossil fuels like petrodiesel, B20 reduces carbon emissions by 16% on average, with B100 reducing carbon emissions by 80%.

Proactive fleets like the Chicago Park District in Illinois have realised significant benefits from using biodiesel blends in their operations. With one of the highest asthma rates in the country, Chicago was looking for an effective and sustainable way to reduce harmful vehicle emissions as well as address its carbon reduction goals. They found the answer in biodiesel. The Park District began using biodiesel blends in its 2013 fleet of more than 250 diesel vehicles and now successfully uses blends between B10 and B50 year-round. By using biodiesel, their annual reductions in CO<sub>2</sub> emissions are equivalent to planting over 1,500 trees per year.

This is just one of the many biodiesel success stories that we are sharing with fleets, industry stakeholders, partners and others, to demonstrate that biodiesel blends are here and now. We will continue working to capitalise on the potential for biodiesel growth as predicted by the NTEA survey, while simultaneously pursuing our ongoing technical work on fuel quality, OEM partnerships and more. ●

Ethanol industry must continue to foster open markets following record 2018

# An open door policy

by **Craig Willis**, senior vice-president of global markets at Growth Energy

**E**arlier this year, the US Department of Agriculture's (USDA) Foreign Agricultural Service (FAS) released the final 2018 ethanol export numbers – bringing the year to a record 1.7 billion gallons in exports. Last year marked the sixth consecutive year of continuous growth in ethanol exports, with 2018 seeing an impressive 23.7% increase in exports from 2017, which translates to an additional 326 million gallons shipped globally. This growth trend is even more remarkable given several new and ongoing trade barriers that limited American producers' and farmers' ability to take full advantage of global ethanol demand.

Among global producers, the US and Brazil are both the world's largest producers and consumers of fuel ethanol. While the US nearly doubles the amount of finished ethanol Brazil produces annually, Brazil only trails the US by 8 billion gallons, making up 26% of total global exports in 2017, according to the

US Department of Energy.

The nation is also a major importer of ethanol fuel and was the largest destination for US ethanol in 2018, importing a record 513 million gallons for the year. Brazil makes up nearly a third of our exports annually and is crucial to providing a stable export outlook for American ethanol producers, despite a 20% tariff on all imports of US ethanol over 39 million gallons per quarter. However, its unusually high blend requirements, coupled with its domestic production, make Brazil the exception, not the rule, in terms of understanding and forecasting global ethanol markets. Due to its own crop harvest and domestic production, the volatility of ethanol demand in the Brazilian market means that American producers will need to cultivate new markets to ensure stable growth in the long-run.

Established markets – such as Canada – as well as some smaller, emerging markets are therefore increasingly prominent in



Craig Willis

the global ethanol outlook. This is especially the case as countries like China, India, Columbia, and others begin to consider adopting higher blends of ethanol fuel.

Of particular interest to the ethanol industry is China. As the second largest single gasoline consumer globally, the Chinese market represents potentially hundreds of millions of gallons in new ethanol demand annually. In 2017, the Chinese government announced a plan to implement their own biofuels standard that would move them to a 10% nationwide blend by 2020. Since then, the government has successfully integrated biofuels into the country's fuel stream at the provincial level. However, in 2018, trade tensions have limited the opportunities for ethanol exports to China and could hamper the speed at which the country is able to achieve a 10% nationwide blend rate.

Reducing trade barriers in countries with existing or

newly formed ethanol fuel standards will, therefore, continue to be a critical issue for the US ethanol and agriculture industries in 2019. The Canadian market, in particular, is the perfect example of how open markets and cooperation can foster growth in biofuels. We hope to see continued progress in key markets like Canada – a country which has maintained open and fair trade with the US – and carry that lesson to new markets. We anticipate that Canada's incremental changes to its blending requirements will continue to grow the market year-over-year and ensure a smooth transition to the adoption of higher blends of ethanol fuel in the country's fuel stream. Continuous engagement and work alongside Canadian biofuels producers has fostered a move to higher blends such as E10 and E15, at the national and provincial levels respectively, and demonstrated the value of ethanol for both its economic and environmental benefits.

Growth Energy has worked hard to establish strong trade ties internationally to ensure continued growth for ethanol, submitting comments in support of biofuels to government entities in Canada, the European Union, the UK and Japan. As countries attempt to reach higher nationwide blends of ethanol fuel, the value that US ethanol exports offer will become increasingly apparent, and if 2018 is any indication for 2019, the opportunities for growth around the globe are tremendous. ●



US ethanol exports increased by 23% between 2017 and 2018 – ending the year at a record 1.7 billion gallons

# Seizing the opportunity

## Reconciling the REDII and climate ambition in EU Member States

The EU is committed to carbon neutrality by the middle of the century, but long-term objectives require ambitious action today. The clean energy and climate package, including a set of legislations to ensure the EU is on track to reduce greenhouse gas (GHG) emissions by at least 40% by 2030, have now all been adopted. An important legislation is the Effort Sharing Regulation (ESR), which obliges each Member State to reduce GHG emissions in sectors that are not covered by the EU Emissions Trading Standard (ETS), i.e. transport, buildings, waste and agriculture. The largest emitter of all is the transport sector and it remains the most difficult nut to crack from a climate perspective. Indeed, GHG emissions in transport are still increasing in most Member States. In fact, GHG emissions across the EU rose slightly in 2017, mostly because of the increase of oil consumption from road transport.<sup>1</sup>

A fair question to ask is whether all the new legislations adopted will be sufficient to address the transport challenge. Carbon dioxide (CO<sub>2</sub>) emissions from cars need to be reduced by 15% in 2025 and 37.5%

in 2030 versus the 2021 baseline. CO<sub>2</sub> emissions from heavy-duty vehicles (e.g., buses and trucks) need to be decreased by 15% in 2025 and 30% in 2030 versus the July 2019–July 2020 baseline. There are also incentives for electric powertrains, which are considered zero emission vehicles. These two legislations on CO<sub>2</sub> emissions from light and heavy-duty vehicles cover tailpipe emissions only ('tank to wheel'), regardless of whether they use fossil-based or renewable fuel.

The revised Renewable Energy Directive (REDII) governs the fuel that propels these vehicles ('well to tank'),

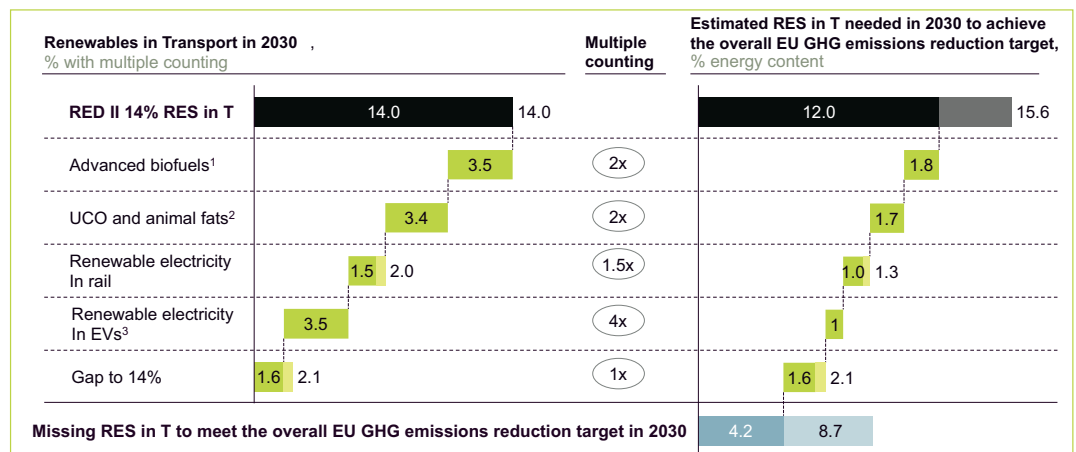
stipulating that 14% of the energy used in transport must come from low-carbon, renewable energy sources. That said, we already know that this target is likely not to be met entirely because of the use of multipliers and limits to the use of conventional biofuels.

The European Commission estimated that it needs between 12% and 15.6% of renewables – in energy content – in transport by 2030 in order to achieve the EU 2030 climate targets. Figure 1 shows that with the use of multipliers foreseen in the REDII, the gap could be as high as 8.7%.

Since transport is the

hardest and most expensive sector to abate, Member States may be tempted to use these multipliers when implementing the REDII. However, that would be counterproductive and a failure to comply, considering the GHG emission reduction they must achieve in the transport sector in line with the ESR. To meet ESR requirements, Member States will need more biofuels than what is required or allowed within REDII. This must be understood clearly when implementing the REDII and all climate legislations at national level.

As progress is being made to decarbonise other sectors,



1 Minimum 2 Maximum, so could be less 3 Estimates based on EC assessment Source: Novozymes, RED II, SYSTEMIQ

Figure 1. The amount of missing renewable energy sources in tonnes needed to meet the overall EU GHG emissions reduction target in 2030

**The following examples illustrate this reality:**

**Germany:** Must reduce GHG emissions by 14% in 2020 and 38% in 2030 in the agriculture, buildings, transport and waste sectors (compared to 2006 levels). It is expected that the 2020 target will be missed because its agriculture and transport emissions have increased in the past years. Significant efforts will therefore be required, especially in transport, which represented 36% of Germany's 2016 emissions. All assessments demonstrate that Germany will need to use more renewables in transport than what the REDII prescribes to reduce adequately GHG emissions in transport.

In a business as usual scenario for

transport, the shortfall by 2030 would be 50.5 million tonnes (Mt) of CO<sub>2</sub> equivalent (CO<sub>2</sub>e), according to the European Economic Area (EEA). This is the equivalent of more than 30 million cars, or two thirds of Germany's total car fleet. Without crop-based biofuels, this shortfall would increase by 4.3Mt CO<sub>2</sub>e. On the other hand, using 6.5% of crop-based biofuels before 2020 – as the national law allows in combination with 3.5% advanced biofuels (without double counting) – could deliver up to 15Mt CO<sub>2</sub>e emissions savings in 2030, more than one quarter of this estimated gap. Going beyond these percentages would further help reduce the shortfall. More

ambition on renewables in transport should be a no brainer for Germany.

**Finland:** The Finnish Parliament has approved a mandate to gradually increase biofuel to 30% by 2030. The law sets a world-leading advanced biofuel sub-mandate of 10% in 2030. The rationale for adopting this ambitious target was based on a comprehensive assessment where Finland needs to be to achieve its 2030 GHG emission reduction obligation in the non-EU-ETS sectors (40%), assuming a percentage of EVs on the market by 2030 and closing the gap with sustainable biofuels.

transport cannot afford to be the weakest link anymore. We already know today that most EU countries are not on track to meet the 10% target of renewables in transport in 2020. At Member State level, only two countries, Finland and Sweden, have already achieved their 2020 targets.

The latest Commission data<sup>2</sup> show that more than 94% of European transport energy is still provided by fossil fuels, only a slight decrease from the 95.8% in 2009. We have basically lost an entire decade. This cannot happen again in the run-up to 2030, which is a critical milestone in terms of our ability to reach carbon neutrality by the mid-century. The next decade will define Europe's ability to meet the Paris Agreement.

Anyone with an interest in climate policy is witness to the great discrepancy between ambition and actions. The next generation realises this, marching across Europe to point out this contradiction and asking for effective short-term action that is in line with long-term objectives.

When scalable solutions exist, it would make sense to use them. In the case of biofuels, the discussion around indirect land-use change (ILUC)/food vs fuel has led many politicians to become risk averse and ignore the

significant role that biofuels can have in the clean energy transition. This ignores the fact that risks associated with biofuels in Europe have been identified and managed by way of designing strict sustainability criteria. As measures are put in place to ensure that the biomass used is sustainable, the policy attention should therefore move on to ensure the increased deployment of sustainable biofuels, such as renewable ethanol, in each Member State.

International Energy Agency executive director Fatih Birol has called bioenergy “the overlooked giant of renewables” and highlighted its critical role in reaching the Paris Agreement. It is indeed urgent that we look at what biofuels and biorefineries at large can provide and how they can accelerate the clean energy transition. Recently, Novozymes outlined what the biorefining platform offers, namely how it can address three key challenges routinely identified by observers of the climate debate.

**Challenge 1: There is no silver bullet to reach net-zero emissions**

**Solution:** The optimal solution is a mix of green energy technologies. Biorefining is key to this mix – not only because its products are sustainable but

also on account of its unique synergies with other green technologies. For instance, carbon-neutral electrification of transport holds great promise as a solution, but it cannot succeed on its own in the time we have to mitigate climate change. Biofuels are needed to achieve sufficient carbon emission reductions across all transport segments.

Biorefineries also complement other types of renewable energy generation. For example, co-products from biorefineries, such as lignin and biogas, can supply electricity to balance intermittencies in a renewable energy grid.

**Challenge 2: There is no crystal ball to determine the extent and speed at which different technologies will succeed in the future**

**Solution:** Accurate prediction is not needed as long as the future energy system can adapt to market needs. In this context, biorefining is valuable because of its ability to adapt its outputs over time to meet future requirements for fuel and materials. Today, biorefineries primarily produce liquid fuel for passenger cars, but in the longer term they can be adapted to cater to other segments, such as shipping, aviation and other applications, including biochemicals.

**Challenge 3: There is a need for negative emissions to meet the international climate targets**

**Solution:** The Intergovernmental Panel on Climate Change highlights the need for negative carbon emissions as soon as possible to keep the temperature rise below 2°C. Biorefining offers one of the easiest and cheapest forms of achieving negative emissions. The fermentation process emits a CO<sub>2</sub> stream that is relatively clean and concentrated, thereby enabling its cost-efficient capture and storage.

Now that EU Member States have started to implement the REDII and explore different pathways to meet their 2030 and longer-term climate obligations, it is an opportunity – and instrumental – to consider these benefits, and ensure that the full potential of this transformative vision can be achieved. ●

**Footnotes**

1. Source: <https://www.eea.europa.eu/highlights/increase-in-eu-greenhouse-gas>
2. Source: <https://ec.europa.eu/eurostat/web/energy/data/shares>

**For more information:**

This article was written by Nour Amrani, in charge of EU public affairs for Novozymes (Brussels, Belgium). Visit: [www.novozymes.com/en](http://www.novozymes.com/en)

US biodiesel demand bleeds lower on exemptions

# Lost demand

by **Brian Milne**, editor and product manager at DTN



Brian Milne

**S**oy methyl ester biodiesel at key hubs in New York Harbor, Chicago and Houston traded at \$0.70 to \$0.95 gallon premiums to nearest delivered ULSD futures on the New York Mercantile Exchange in February and March, down sharply from the \$1.10 to mid-\$1.30 gallon premiums traded year prior, with the current weakness emerging in the second quarter 2018. It was about that time when the industry was becoming aware of a raft of small refinery exemptions (SREs) issued by the US Environmental Protection Agency (EPA) that biofuels advocates decry as undercutting the Renewable Fuel Standard (RFS).

Scott Irwin, an agricultural economist at the University of Illinois, calculates the liberal issuance of SREs has led to demand destruction of 2.5 billion gallons of biomass-based diesel during 2016 through 2018, and is set to exceed 700 million gallons this year.

On 28 March, EPA issued its 35th SRE for the 2017 compliance year out of 37 petitions with one pending compared with 19 exemptions granted for 2016 out of 20 petitions submitted to the

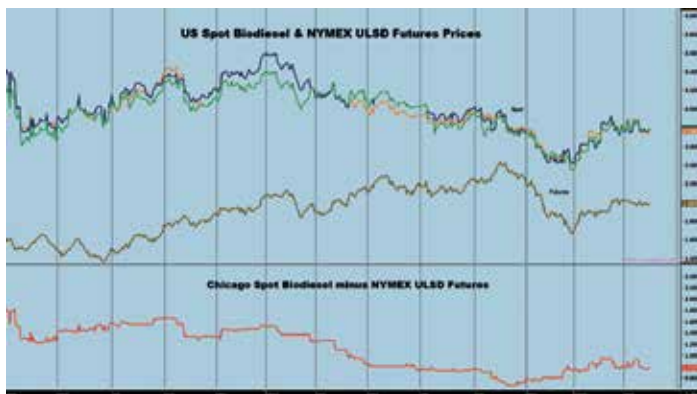
federal agency. There are 39 SRE petitions submitted for the 2018 compliance year.

“The 2017 volumes for biomass-based diesel were set at 2 billion gallons, well below the industry’s proven ability to produce fuels. Now, the retroactive small refinery exemptions for 2017 have cut the obligation by more than 240 million gallons or 12%,” said Kurt Kovarik, vice-president of federal affairs for the National Biodiesel Board. “Because they’re retroactive exemptions, the reduced demand for biomass-based diesel will hit our industry throughout 2019.”

Mandated demand for biomass-based diesel under the RFS was 2.1 billion gallons in 2018 and again this year, increasing to 2.43 billion gallons in 2020. Biodiesel and renewable diesel can also satisfy the advanced biofuel nested category under RFS, which is 4.92 billion gallons in 2019, up from 4.29 billion gallons in 2018. Biomass-based diesel is the marginal gallon that can fill the “conventional gap,” or mandated ethanol demand under the RFS above E10 providing additional demand pull.

While ethanol adds an oxygenate to gasoline required by environmental regulations in federal reformulated gasoline zones in the US in an effort to reduce air pollution, in addition to being a cost-effective component in boosting octane, there is no compulsory reason to use biomass-based diesel in transportation fuels outside the RFS. As Irwin notes in his farmdoc series, this makes the biomass-based diesel mandate “highly binding.”

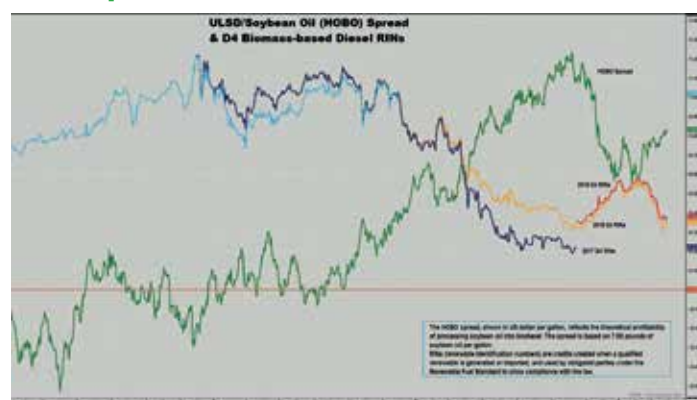
## Spot biodiesel



## ULSD seasonal chart



## HOB0 spread RINs



EPA estimates SREs have exempted 17.05 billion gallons of gasoline and diesel volume from falling under the RFS in 2017, up from 7.84 billion gallons in 2016.

The exemption in gasoline volumes from the mandate holds ethanol’s concentration in the gasoline pool below the 10% blend wall, closing the conventional gap that

further erases demand for biomass-based diesel.

Lost demand due to SREs has pressured prices for both biodiesel sold in the physical market and especially for Renewable Identification Numbers (RINs), credits submitted to the EPA to show compliance with the RFS. RINs move with the biofuel in the supply chain, and can also be sold separately in the open market. EPA estimates the number of RINs exempt for 2017 at 1.82 billion, more than double the 790 million exempted RINs in 2016.

Undoubtedly the diminished mandate has slowed the growth rate in production, although US biodiesel output continues to expand. A healthy production margin has helped in defraying lost revenue from lower RINs and physical prices.

The Energy Information Administration (EIA), the statistical and analytical division within the US Department of Energy, shows US biodiesel production declined to a nine-month low at 144 million gallons in January, although each year output begins at its lowest point and works higher, especially during the second half of the year. EIA data

shows January output up 19 million gallons or 15% from January 2018 and 51 million gallons or 55% above the January 2017 production rate.

EIA indicates biodiesel production in 2018 at 1.853 billion gallons, up 257 million gallons or 16% from 2017, and against capacity of 2.5 billion gallons. EIA projects US biodiesel production at 2.2 billion gallons this year and 2.4 billion gallons in 2020.

Another factor slowing output growth in the US is an expired tax credit that paid \$1 per gallon for blending biodiesel or renewable diesel into petroleum-based diesel. Congress retroactively reinstated the credit for 2017 last year, but failed to agree to extend it for 2018 and beyond. A current proposal would extend the \$1 gallon blending credit through 2021, and begin phasing it out in 2022 when the credit would pay \$0.75 per gallon, reduced to \$0.50 in 2023 and \$0.33 in 2024.

Processing soybean oil into biodiesel remains profitable based on the spread between NYMEX ULSD futures and Chicago Board of Trade soybean oil futures known as the HOBOSpread, which has trended higher since early February.

Reduced feedstocks costs and a boost in diesel prices have lessened the deleterious effect of collapsing RIN values experienced by producers.

The theoretical producer margin began the second quarter at a four-month high, boosted by lower soybean oil futures under pressure from record high soybean stocks in the US at 2.716 billion bushels. Increased soybean production in South America and world record high supplies are capping the upside in soybean and soybean oil futures. A bilateral trade agreement between the US and China would likely trigger a rally in soybean futures adding to biodiesel producer costs, but could be offset by increased demand for diesel if world trade flows expand.

Biodiesel remains a top choice for truck fleets, according to the National Truck Equipment Association (NTEA). NTEA said its annual Fleet Purchasing Outlook Survey found for the third year out of the past four, fleets name biodiesel as their number one choice for alternative fuel use.

Biodiesel demand might pick up in the second half of 2019 in advance of the 1 January 2020 effective date

for International Maritime Organization's regulations that mandate a reduction in marine fuel sulphur requirements from 3.5% to 0.5% in oceangoing vessels globally. Marine vessels consume about 4.3 million barrels per day according to the International Energy Agency, about 4% of global oil demand.

The mandated decline in marine fuel's sulfur level will mean it will compete with diesel fuel, with the market for compliant marine or bunker fuel expected to be very tight when the regulation takes effect. Middle of the barrel yield is also struggling with reduced availability of heavy crude oil globally amid US sanctions on Iran and Venezuela, while in the US, the surge in tight shale oil production is a very light oil ill-suited for expanding diesel output. ●

**For more information:**

Brian L. Milne is the energy editor with DTN, an independent, trusted source of actionable insights for 600,000 customers focused on feeding, protecting, and fuelling the world. Customer-centric and employee-driven, DTN focuses on empowering agriculture, oil and gas, trading, and weather-sensitive industries through continuous, leading-edge innovation. DTN is based in Minneapolis, with offices globally.

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US policy uncertainty continues to weigh on prices

# Uncertainty remains

Relative to a European biodiesel market sedately transitioning from winter to summer demand, US biofuels traders have had to negotiate logistical turmoil due to flooding across much of the Midcontinent, which has disrupted product flows from the Midwest production hub to the main demand centres in the Gulf and on the US West Coast. US biodiesel output has otherwise been making slow progress, with less than 2% growth in the first two months of this year, as renewable diesel producers continue to grab market share, a trend that is only set to accelerate as developers continue to progress construction plans on new units.

US policy uncertainty continues to weigh on prices, with the US Environmental Protection Agency's (EPA) slew of Renewable Identification Number (RIN) waivers for small refineries set to be joined by another list of exemptions by the end of March, destroying demand across the Renewable Fuel Standard (RFS) 2 Federal mandate and leaving California to do more of the heavy lifting in terms of regional demand stimulus. Other states are making quick strides to

building demand into their own clean fuel standards. This will tip the balance in the US biofuel market further away from crops and towards output growth in product made from recycled oils, after signs of an accelerating shift in that direction at the start of this year. Once these plants are up and running, the US appetite for waste oils and greases imported from overseas is likely to accelerate in competition to Europe, as domestic supplies are rapidly overwhelmed by new processing demand. Several developers are currently progressing plans to build new units around deep-water port access, a worrying signal to the European market, which currently relies on the US and Asia to make up for its net short in waste fats and greases to meet double count and low carbon intensity fuel demand.

European biodiesel imports are higher profile than in the US market, where overseas sellers are now restricted to Canadian, European and other small origins, since tariff walls locked out Argentina. A large chunk of Argentinian output has been fixed to ship to Europe in the next quarter, although Argentinian sellers complain that this arbitrage is now

unworkable, thanks to unspectacular EU FAME prices. China has continued to dominate the European wastes market meanwhile after seizing the crown as top exporter in 2018, with buyers waiting for summer blending demand to pick up amid a depressed prompt pricing environment under pressure from cheap inflows of PME and SME. Prices have been depressed thanks to a weak prompt FAME Zero market.

Cheap palm oil has drawn more Chinese biodiesel buyers into discretionary blends of PME as clean transport fuel demand continues to swell across Asia. The Indian government is ploughing ahead with efforts to build a sizeable domestic mandate for ethanol, approving soft loans and interest waivers for operators looking to convert surplus sugar cane into fuel. This in turn has left more room for US ethanol to enter India's unprotected industrial buying sector, a godsend for a US industry otherwise drowning in surplus inventories in a market that keeps losing blending headroom to EPA waivers. ●

**For more information:**

This article was written by Matthew Stone, managing director at PRIMA.

## PRIMA Markets Global Biofuels

Prices assessed: 27 March 2019



Research  
Biofuels

### Europe & N Africa

T2 UCO FOB ARA (EUR/mt)	629.50
T2 UCO FOB NWE (EUR/mt)	664.50
T1 UCO CIF ARA (USD/mt)	627.50
UCOME FOB ARA 0 CFPP (EUR/mt)	847.00
TME FOB ARA (EUR/mt)	830.00
T2 Animal Fat Cat 3 (EUR/mt)	535.00
UCO CIF Lisbon (EUR/mt)	580.00
UCO FOB N Africa (USD/mt)	555.00

### Asia

UCO FOB China Bulk (USD/mt)	615.00
UCO FOB China Flexi (USD/mt)	580.00
UCO FOB South Korea (USD/mt)	630.00
Palm Olein FOB PKPG (USD/mt)	535.00
CPO FOB Dumai (USD/mt)	495.00
POME FOB Malaysia (USD/mt)	400.00

### United States

UCO FOB California (cents/lb)	28.00
UCO FOB Houston (cents/lb)	28.50
Corn Oil FOB Midwest ethanol plant (cents/lb)	25.00
UCOME FOB California (USD/gal)	3.30
HVO FOB Los Angeles (USD/mt)	4.49

### Emission Credits (USD/mt)

LCFS Credits	194.00
Oregon OCFP	155.00

### South America

Anhydrous ethanol	535.00
FOB Santos (USD/m <sup>3</sup> )	
SBO FOB Argentina (USD/mt)	633.20
SME FOB Argentina (USD/mt)	771.70

Political instability in Europe hinders biofuels progress

# Europe's political turmoil invades REDII tranquillity

by **Colin Ley**

Running any type of business in Europe is challenging enough at present, let alone one loaded with the additional pressures generated by the region's slow march towards the development of biofuels as a major contributor to the continent's energy mix.

Not only do we have Brexit overhanging the EU, with all the doubt and indecision that includes, but also the need to negotiate a new round of European Parliamentary elections at a time when so-called populist movements across the EU27 are threatening to seriously disrupt the status quo in Brussels and Strasbourg.

With France's *gilet jaune* (yellow vest) protests continuing to capture the weekend headlines, a full five months after they began, the prospect of the country's voters sending a significant number of revolutionary representatives to Strasbourg at the end of May has to be considered a real possibility. It also needs to be recognised by fuel sector producers and investors that it was rising fuel prices that sparked the initial *gilet jaune* road blockades and city demonstrations, with the French government's environmental policies being blamed by protestors for many of the price hike problems.

Although the *gilet jaune*

movement is about far more than adding an extra cent or two to the cost of running the family car, the fuel/environment factor cannot be ignored.

Add to all this, the approaching departure from power of German Chancellor Angela Merkel, and the fragile nature of European politics and business has clearly created a climate in which building and running a biofuels enterprise is not for the faint-hearted.

## REDII stability

In truth, this should really be a vintage time for European biofuels, if only the politicians and protestors would move aside. We do, after all, have the revised Renewable Energy Directive (REDII) in place, finally approved and settled, and slowly being worked through at a practical level by the industry. EU Member States have their 2020 targets to hit and 2030 goals to follow

the game were changed every two to three years, a pattern which inevitably made the implementation of a coherent biofuels policy at Member State level quite hectic, to say the least.

"While some countries took their biofuels targets seriously, therefore, and made good progress as a result, others were just sitting and waiting for the discussions to be concluded and REDII put in place.

"I'm not saying the European Union has created the perfect policy, by any means. Any such agreement involving so many different countries and interests is bound to require a degree of compromise to get a final document over the line, a fact which means just about everyone has something to be unhappy about. At least, however, we now have some clarity about where we're heading and what we want to achieve, and that's a major step forward."

In this context, Desplechin said he was looking forward to Member States now working to achieve their 2020 targets in relation to drawing at least 10% of their transport fuels from renewable sources, while also ensuring that the pathway is clear for the EU to then progress towards its even more ambitious 2030 fuels targets.

*"Prior to REDII, we lived in a business and political climate where the rules of the game were changed every two to three years"*

When *Biofuels International* asked Emmanuel Desplechin, secretary general of ePURE, therefore, if he remained optimistic about the future of European biofuels, it was easy to understand his response.

"If I wasn't an optimist, I wouldn't be in this business," he said, albeit delivering his comment with a similar degree of humour attached to the well-known notice displayed on countless office desks that you don't have to be mad to work here, but it certainly helps.

beyond that. In many ways, the path forward for biofuels in Europe is clearer now than it has been for several years.

"The outlook for European biofuels is more positive today than it was, certainly more positive than two years ago," said Desplechin. "We have achieved REDII, defining sector policy for the next 10 years, and are finally starting to bring some stability to the industry in Europe.

"Prior to REDII, we lived in a business and political climate where the rules of

“That will mean all Member States putting ethanol blends, such as E10, into their policies, with higher follow-on blending rates being embraced than we’ve seen so far,” he said.

According to the latest figures, and somewhat ironically, *gilet jaune* France is the most advanced E10 user in the EU, with its motorists making the country’s 10% ethanol blend the top-selling French petrol. There has also been a marked increase in French sales of E85 petrol, which are reported to have increased by 55% in the last year.

### UK lags behind on E10

Across the English Channel, meanwhile, the transport fuels sector remains stuck at E5, with most of the blame for this being directed towards the UK government and its reluctance to give a positive lead regarding E10 implementation.

“The frustration over E10 in the UK is that the government there has been thinking about it and organising stakeholder consultation on the issue but has so far failed to act on it,” said Desplechin.

“In addition, what the UK government has been saying is that if stakeholders want to move to E10 then they’re perfectly free to do so.

“We all know, of course, that nothing will happen regarding E10 in the UK without government intervention, as no one stakeholder will want to become the first mover, running the risk of losing sales in the process.”

A similar point was made by Gaynor Hartnell, head of renewable transport fuels at the UK’s Renewable Energy Association (REA), who was also responding to questions from *Biofuels International*.

“No oil company will want to take unilateral action on E10 in the UK,” she said. “However, the industry at large would welcome being told by the government to



move ahead and offer the blend. They just want to make sure they are all going to do it at the same time.”

### ‘Seat of the pants’ solution

With Brexit negotiations and knock-on trade and tariff scenarios dominating discussions in the UK at present, however, there’s no current sign of the British government finding time or manpower to move the E10 issue forward.

For UK businesses, anxious that separation from the EU will radically shift Britain’s stance on greenhouse gas (GHG) regulations, however, the view from Hartnell is that there’s no evidence of such major changes being likely.

“Although no one really knows what knock-on effects Brexit will have on business developments over the short or long term, all the signs are that the UK’s current decarbonising transport policies will remain as they are at present after Britain’s departure from the EU,” she said.

“I think we’ll see the

approach to GHG reduction carrying on as it is, even though many of the policies were initially triggered by the UK’s membership of the EU. There’s an assumption in the UK that the changes coming through under REDII will continue to be implemented.

“In short, I don’t see the big picture on GHGs, renewables or biofuels suffering Brexit-related changes to the targets to which the UK has already committed.”

The expectation at present, of course, is that the UK will mirror existing EU trade remedies for bioethanol and biodiesel, in the immediate aftermath of Brexit, with the proviso that such remedies will be reviewed, as necessary, at an early stage. It also appears to be the UK’s ‘intention’ that all its mirrored EU measures will be reviewed when time and resources allow, regardless of subsequent EU activity.

Not surprisingly, there are some within the UK industry who view all this as something of a ‘seat of the pants’ solution, which may not stand up to scrutiny once the deals and no-deals

start to shift from theory to reality. The view from the EU side of the Channel, on the same issue, is probably best described as ‘enlightening’.

### UK exposed to US ethanol imports

“While the British government’s no-deal plan applies the same tariffs to biodiesel and bioethanol as in the EU, ethanol in the UK still appears to be the most exposed sector to resumed imports from the US,” said Desplechin. “In such a situation the UK would be the ones to suffer.

“Given that the surplus of ethanol production from the US is more than the equivalent of the entire European market, it’s easy to imagine what would happen if American exports started to flow into the UK. The fate of Britain’s bioethanol refineries would certainly be at risk.”

As always, mixing politics and business rarely produces a good blend, certainly not one which makes life any easier for Europe’s biofuels community. ●

Wood-based UPM BioVerno diesel reduces air polluting emissions

# Finland's bold biofuel targets

**E**missions from road transport are considered more harmful than those from other sources, as most emissions occur in urban areas where people live and work. Nitrogen oxides (NOx) and particulate matter (PM) are the worst pollutants in exhaust gases.

NOx is being emitted when fuel is being burned, for instance in traffic, industrial processes and power generation. Burning fossil fuels is by far the main manmade source of NOx. In areas of high traffic, the NOx emitted can be a significant source of air pollution. Long-term exposure to nitrogen oxides can increase the risk of respiratory conditions and sensitivity to allergens.

Particulate matter (PM) emissions affect human health – small particles can penetrate deep into the lungs and cause respiratory problems. During rush hour in cities, PM concentration can be up to 100 times higher than during quieter periods.

However, technology is developing fast, both in



Lower particulate and nitrogen oxide emissions were noted in Vuosaari Harbour when VTT measured tailpipe emissions of renewable UPM BioVerno diesel in comparison to fossil diesel used in a Volvo wheel loader

cars and fuels, and some of the latest diesel cars on sale today produce zero or near-zero harmful NOx. Furthermore, in many cases, the new diesel vehicles tested emitted even less NOx than an equivalent petrol model.

The same concerns fuels. Renewable diesel today is

known to significantly reduce greenhouse gas emissions, but it also ignites more quickly, burns more completely during the combustion process, and reduces harmful tailpipe emissions compared to fossil fuels. High quality sustainable biofuels are a cost-efficient alternative to help reduce traffic emissions and they can be adopted without any changes to vehicles.

## Cleaner city traffic with wood-based renewable diesel

Wood-based UPM BioVerno diesel reduces carbon dioxide (CO<sub>2</sub>) emissions by 80%, but the latest results confirm that it also reduces air polluting emissions. The recent test in Vuosaari Harbour in Helsinki focused on measuring the

tailpipe emissions of a Volvo wheel loader construction vehicle. These were a continuation of similar bus and vehicle emission tests carried out by the VTT Technical Research Centre in Finland. Both NOx and PM emissions were around 10% less when compared to a fossil reference fuel. However, the average load of the wheel loader during the test was low. A heavier load would have produced more particles, and there would probably have been greater reduction in particle emissions while using the renewable diesel. The results of emission tests also depend very much on the type and age of the engine.

UPM BioVerno diesel has been trialled in engine and vehicle tests on numerous vehicle makes and models,



The recent test in Vuosaari Harbour focused on measuring the tailpipe emissions of a Volvo wheel loader construction vehicle



UPM Lappeenranta Biorefinery in Finland produces residue-based advanced biofuels (renewable diesel and naphtha)

including Euro III and VI class buses, and heavy-duty engines in several acclaimed Finnish and international research facilities. In previous engine tests, the tailpipe emission reductions have reached 30–40% with UPM BioVerno compared to fossil fuels. The fuel significantly reduces both PM and NOx emissions, as well as carbon monoxide and other hydrocarbon pollutants.

### Finland sets bold targets for biofuels

At the end of 2018, European institutions finally agreed on the Renewable Energy Directive, REDII, which will increase the use of renewable energy to 32% in 2030 and requires 14% bioenergy to be used in transport. All European Union (EU) Member States are obliged to implement a binding advanced biofuel blending mandate starting in 2022. Advanced biofuels are now recognised as a fast-track route to the decarbonisation of transport across the EU, and this agreement will further boost interest in the most

sustainable biofuels and strengthen the position of advanced low-ILUC (indirect land-use change) fuels.

An increasing number of countries are already identifying ways to reduce transport emissions and looking at boosting the uptake of advanced biofuels. Finland has been a frontrunner in setting ambitious targets for renewable energy in the transport sector. While the EU has a 10% target by 2020, Finland's target is 20%. The Finnish Parliament has recently approved legislation that sets a gradually increasing 30% biofuels target for 2030. Furthermore, the law sets a world-leading advanced biofuels target of 10% in 2030.

This 10% objective is a sub-target included in the 2030 30% target. In Finland, advanced biofuels are those produced from sustainable raw materials listed in the EU Renewable Energy Directive's Annex IX Part A.

To reduce emissions further beyond 2020, utilisation of the whole toolbox is required – we need all financially and technologically feasible

means, from sustainable biofuels to electrification and engine efficiency improvements, to be deployed. For heavy-duty vehicles there are fewer options than for passenger cars, thus diesel remains the dominant fuel. In fact, 70% of global diesel is consumed in heavy-duty road transport and demand is projected to grow substantially.

The advantage of high quality liquid biofuels lies in the fact that neither new vehicles nor a new distribution infrastructure is required. At best, advanced biofuels reduce greenhouse gas emissions caused by the production and use of fuel by 80–90% compared to

fossil fuels. In addition, local emissions can be reduced through the targeted use of advanced biofuels. The air polluting emissions, such as PM and NOx, can be reduced significantly by using renewable diesel, especially in older vehicles and machinery. Therefore, sustainable biofuels play an important role not only in achieving the Paris Agreement targets, but also in driving cleaner city traffic. ●

### For more information:

This article was written by Sari Mannonen, vice-president at UPM Biofuels. Visit: [www.upmbiofuels.com](http://www.upmbiofuels.com)



Workers at the UPM Lappeenranta Biorefinery in Finland

*“Finland has been a frontrunner in setting ambitious targets for renewable energy in the transport sector”*



IMERYS

# CynerSorb®

## Mineral adsorbent and feedstock flexibility

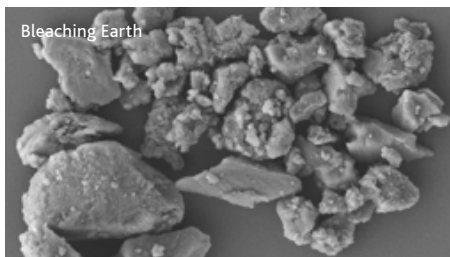
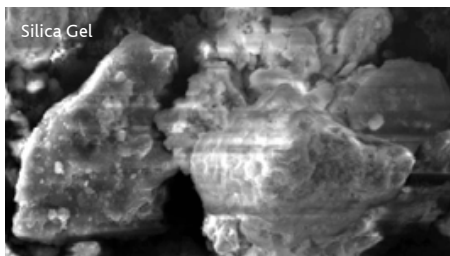
### INDUSTRY CHALLENGES

There are a number of challenges facing oleofuel producers today. Worldwide renewable diesel (HVO) production is anticipated to triple in the next decade\* However, at the same time, refiners are looking to incorporate lower quality (waste or novel crop-based) feedstocks into their process.

This has been a major focus for Imerys in 2018 – how can we assist oleofuel producers in incorporating these new feedstocks into their existing process, so that they can produce more, at a lower cost and with no negative effective on refined product quality; what Imerys refers to as "Feedstock Flexibility".

Feedstock preparation prior to conversion is essential to downstream processes. Eliminating key contaminants improves conversion and separation, can extend catalyst life (HVO) and limits final product quality variations. Pretreatment is often performed using either a mixture of acid/alkali washing ("wet wash") or via a mineral adsorbent "dry wash" – of often a mixture of the two. While both these processes are functional for current higher quality feedstocks, lower quality feedstocks can be problematic.

These feedstocks generally have a higher level of contaminants to be removed, so requiring higher adsorbent application rates, more chemical dosing and extended water washing; not good when water footprint is now becoming more topical. Also post water usage treatment costs can be significant. This negative effect on operating costs is also associated with a potential reduction in refining capacity, especially with the mineral dry wash; more contaminants means higher dosing rates so reducing filter cycle length. With this in mind, Imerys has developed its CynerSorb® Filterable Adsorbent range.



Microporous structure of CynerSorb® (top) providing improved filtration performance vs. Silica Gel (middle) and Bleaching Earth (bottom).

### CYNERSORB® FILTERABLE ADSORBENTS

The main disadvantage of current mineral adsorbents such as bleaching earths and silica gels is their poor filtration characteristics. Often filtration is stopped due to high filter inlet pressure long before the filter is full, thus leading to much under-utilized filtration capacity. The secret of CynerSorb® is that structurally it resembles a diatomaceous earth filter aid (used as the mineral filter aid of choice for decades in multiple industries). Imerys have succeeded in surface engineering each particle so that they also adsorb the very contaminants that need to be removed during the refining process – e.g. soaps, phospholipids, and trace metals.

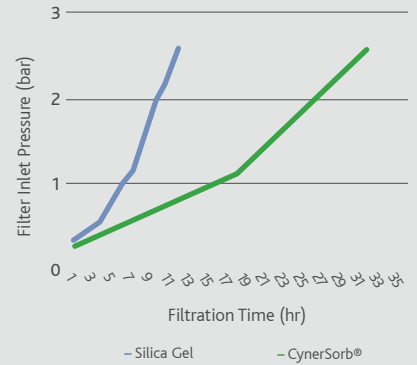
This surface engineering means that all adsorption sites are readily available – no need for a prolonged hydration time. The result; superior adsorption and filtration performance, even on lower quality feedstocks – allowing for lower dosing rates, extended filtration times, less yield losses and lower contaminant levels post treatment.

Reference: \*(source grenea; Market Watch Feb 2019)

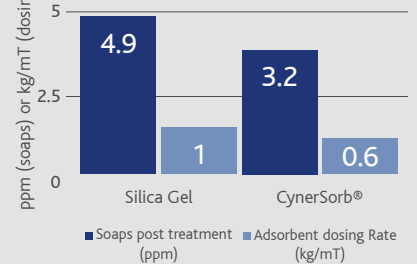
### THE PROOF

#### CUSTOMER A

Evolution of Filter Pressure with Time: CynerSorb® vs Silica Gel



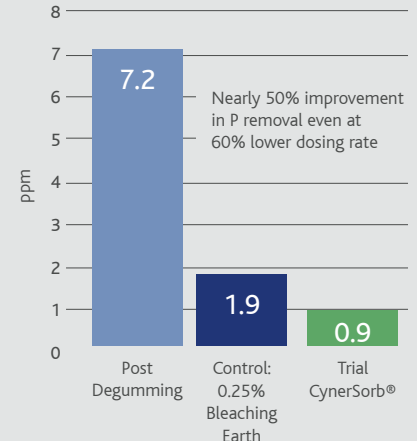
Soap Removal vs Dosing Rate: CynerSorb® vs Silica Gel



CynerSorb®– was used to replace a conventional silica gel in the chemical refining of soyabean oil for biodiesel production (ca. 100k mT refinery). The superior filtration characteristics of CynerSorb® meant that there was a significantly lower pressure increase on the filter; nearly doubling filter run length. The superior adsorption properties gave 35% improvement in soap removal, even using 40% less adsorbent.

#### CUSTOMER B

Phosphorous Removal Post Degumming: CynerSorb® vs Bleaching Earth



CynerSorb®– potential to use as a replacement for bleaching earth adsorbent post acid degumming in the physical refining of rapeseed oil for biodiesel.



Researchers discover new bacterial species associated with lignin bioconversion of industrial waste

# How camel crickets may boost biofuels

Chemical and enzymatic degradation of wood (lignocellulose) has long been the focus of the biofuel industry. The use of lignocellulose as a feedstock for biofuel production prevents competition with crops used for food.

One of the major hurdles of lignocellulose biofuel production is efficiency for large scale production. Many pre-treatment strategies have been proposed which include use of acidic

solutions, alkaline solutions, physical, heat, steam and enzymatic<sup>1</sup>. High chemical and energy input results in high cost. Limited chemical and energy input results in long pretreatment time<sup>2</sup>.

Combined pretreatment strategies, especially those that use biological and chemical treatments, could result in more accessible cellulose, with less energy and chemical input. This approach means organisms and enzymes would be needed that are active at a wide

variety of pH, and bacteria can provide these enzymes<sup>3</sup>. Previous approaches to find these enzymes have isolated bacteria from lignocellulose, termites and paper mill sources<sup>4</sup>. This study looks at household arthropods as new sources of bacterial lignin degrading enzymes.<sup>5</sup>

## Lignocellulose breakdown

Two household insects were used in this study<sup>5</sup>, the greenhouse camel

cricket (*Diestrammena asynamora*) and the hide beetle (*Dermestes maculatus*). They were surface sterilised, homogenised and then plated on black liquor. The bacterial colonies that grew were then screened on a variety of media with different components as the sole carbon source: milled hardwood and softwood, BioChoice Lignin, carboxymethyl cellulose, beechwood xylan and xylose, as well as three different concentrations of black liquor. Many of these

bacterial isolates were able to grow on one or more of these compounds, however, those that were able to grow on lignin as the sole carbon source were selected for further study. One of greenhouse camel cricket isolates *Cedecea lapagei* (*C. lapagei*) was able to grow on lignin, milled hardwood, milled softwood, xylan and cellulose. To determine the enzymes allowing growth on lignocellulose components, the genome of this bacterium was sequenced and used to identify proteins being produced when *C. lapagei* was grown on lignocellulose components using LC/MS/MS analysis.

### Resulting bacterial strains

From just three greenhouse camel crickets, a total of nine different bacterial strains were isolated and identified that were able to grow on lignocellulosic components<sup>5</sup>. From three hide beetles, five different bacterial strains were isolated and identified that were able to grow on lignocellulosic components. *C. lapagei* isolated from the greenhouse camel cricket was unique in its ability to grow in a wide range of pH, and grow on all carbon sources tested except for xylose. Liquid cultures of this bacterium when grown on BioChoice Lignin demonstrated the ability to oxidise ABTS, a substrate used to measure laccase activity. Genome sequencing and the liquid chromatography and mass spectrometry, LC/MS/MS, analysis of growth cultures using lignin, cellulose and hemicellulose as the sole carbon source identified several enzymes that were specifically expressed in the presence of these carbon sources. From the 4,287 genes in the *C. lapagei* genome, this work has highlighted 33 unique extracellular enzymes that

*“Lignin is the elephant in the room – a complex and expensive one – for lignocellulosic biofuels. We have been trying to solve it but it may be that arthropods and their bacteria already have”*

are ideal candidates for industrial lignocellulose degradation applications.

### Implications for biofuel production

This work identifies a new bacterium able to degrade lignocellulose: *C. lapagei*<sup>5</sup>. The study also identified several enzymes from *C. lapagei* that are ideal candidates for enzymatic pretreatment. Notably, the techniques described do not rely on sequence similarity to fungal lignin-degrading enzymes and therefore may identify novel enzymes, mechanism of action or enzymatic characteristics, from household insects. Lignocellulose degradation was observed but rate was not measured, which will be addressed in future work. While little is known about this bacterium, it is also possible that genetic engineering could increase the potential to use this bacterium in a microbial consortium for lignocellulosic pretreatment.

In addition to finding novel enzymes, this work outlines a different way to search for lignocellulose degrading enzymes<sup>5</sup>. Ecology and natural history provided insight as to which types of organisms might require the ability to digest recalcitrant compounds. However, the screening methods

were successful with just two arthropods, and other arthropods that live on low-carbon diets should also be investigated. These new sources may host bacteria that produce enzymes with similar action but different characteristics that could ultimately benefit biofuel production. Through the insight of citizen scientists and ecologists, a new source of lignocellulose degrading enzymes was identified. Microbiologists aided in isolation, screening and growth of these bacteria from novel sources. Secretome analysis was used by biochemists to find enzymes produced as a result of growth on lignocellulosic materials instead of looking for enzymes similar to those already known. The collaboration led to novel findings, while future collaborations will continue to deliver new insight into the problem of lignocellulose degradation to produce affordable lignocellulosic biofuels.

### Further developments

Lignin is the elephant in the room – a complex and expensive one – for lignocellulosic biofuels. We have been trying to solve the problem, but it may be that arthropods and their bacteria already have. Bacteria and

their enzymes may not be the best pretreatment when used in isolation, but they may offer more than gaining access to sugars. Bacterial lignin degradation is more complicated than fungal degradation, however their unique enzymes may result in novel metabolic products that can be combined with chemical and physical pretreatment. If so, biofuel production could take the petroleum biorefinery approach, making it possible to use lignin as a valuable feedstock for chemicals. Lignin valorisation for chemicals is not a new idea, but one that should continue to be investigated<sup>1</sup>. ●

### For more information:

This article was written by Stephanie L. Mathews, Department of Biological Sciences, Campbell University. Visit: <https://cas.campbell.edu/>

### Footnotes

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Technologies that can hydrolyse cellulosic biomass are crucial to delivering meaningful volumes of sustainable fuels, says Renmatix's Fred Moesler

# Unlocking the promise of bioindustrial technology



Fred Moesler, CTO at Renmatix

Over the past two decades, there has been tremendous progress in the bioindustrial space. Driven by the need for fossil resource alternatives, we have seen the massive growth of corn- and sugarcane-based biofuels in the United States and Brazil. We have seen the establishment of large bioplastic plants in the United States, Europe, and Southeast Asia. And we've seen the convergence of big data, artificial intelligence, genetic engineering and robotics helping us to develop better biocatalysts faster than ever before. It's been a very exciting time.

Now for the bad news. If we look at the Energy Information Agency's database, we are

continuing to fall behind. Globally, from 2010 forward, growth in fossil resource usage has outpaced renewable usage by nearly four to one: fossil-based energy (petroleum, coal and natural gas) grew at 5.9 quads per year, while renewables (solar, wind and biofuels) grew at 1.5 quads (quadrillion BTU) per year. It is clear that although we have made tremendous progress, renewable energy deployment is still falling behind fossil fuel usage. Furthermore, many of the early players in the biofuel/ biochemical space have fallen due to bankruptcy, technology failure and abdication from the space. Venture and strategic money has largely been left for other related, but non-fuel pastures (pun intended).

If we want to make a significant dent in fossil

fuel usage, we still need to target the commercial fuel and chemical markets, using sustainable methods and materials to produce massively scalable, cost-competitive fuels that can be dropped into existing processes and formulations. Despite challenging obstacles currently holding the industry back, the technology exists to overcome them.

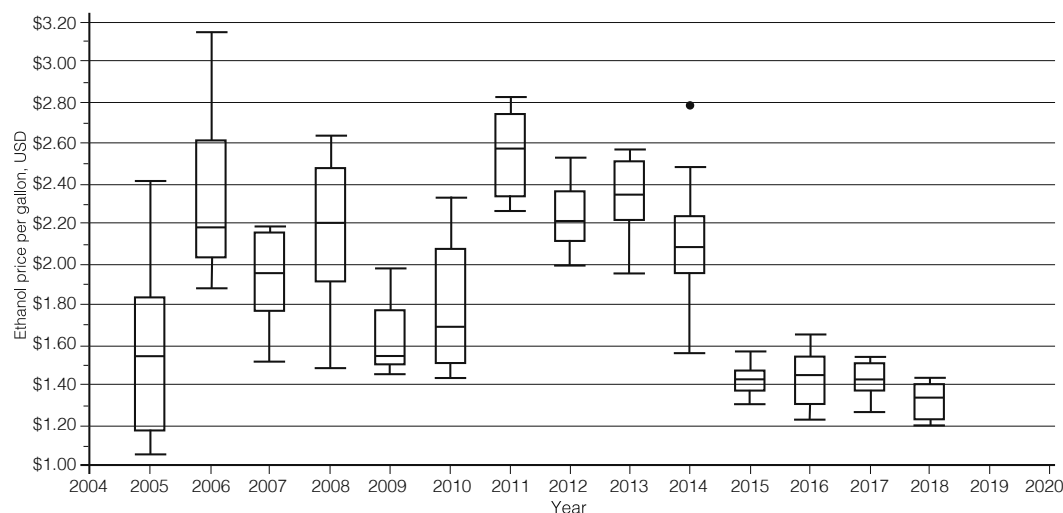
## Current industry obstacles

The largest industry obstacle to date is simple economics. High capital costs and low product value combined with poor quality feedstocks and high operational expenses have prevented even advanced players from producing large amounts of

cellulosic fuels and chemicals.

Historically, companies have focused on using a combination of acids, solvents, catalysts, and/or enzymes to break down the feedstocks (to date, mostly agricultural residuals). Unfortunately, the benefits of these methods are dwarfed by significant drawbacks. For instance, processes that rely on chemicals such as solvents or acids are both environmentally unfriendly and diminish value. Concentrated acids and solvents must be recovered for environmental and economic sustainability, which in turn requires additional capital for the recovery and remediation processes. Many processes require high alloy construction in key areas, further increasing capital

## Ethanol price range per gallon vs year





Feedstocks are separated into multiple products using only water and heat

demands. Other processes, like enzymatic hydrolysis, take place over days and require very large tanks (often vulnerable to contamination) to process the biomass.

Most cellulosic technologies deployed to date are limited to producing fuels, primarily ethanol. As seen in the chart below, ethanol prices have been in a record low range since 2015. With a low-priced primary product, operational costs and byproduct revenue become critical factors.

A further obstacle is that many pretreatments and harsh chemical treatments will impact the molecular weight, purity, and chemical functionality of the lignin component (a potential co-product, which can be as much as 20–35% of the feedstock mass). This often relegates the lignin to use in thermal applications (burning), which is another relatively low value product.

Poor quality or low-volume feedstocks, such as corn stover, sugarcane bagasse and wheat straw, are also problematic. The most abundant biomass with an industrial-proven supply chain is former pulp and paper assets, namely northern climate wood and mills. However, these scalable assets are largely unavailable to bioindustrial producers because of restrictions on renewable identification numbers (RINs), which are

the “currency” of the EPA’s (US Environmental Protection Agency) renewable fuel standard (RFS) programme. Fuels made from this type of woody biomass are not eligible to receive RINs, which means bioproducers cannot get credit for them under the RFS.

If you get through the previous capital, product, and coproduct hurdles, you’re often left with high operational costs. The costs of feedstock, feedstock storage, pretreatment, enzymes and maintenance on a large capital footprint can be economically crippling. Ash content in agricultural

residuals has played particular havoc in eroding pretreatment equipment.

**Look beyond enzymes and organisms**

Technologies exist today that avoid the drawbacks of the solvent/acid and enzyme

approaches. For instance, Renmatix’s proprietary Plantrose Process extracts cellulosic sugars, Omno lignin and crystalline cellulose from plant materials ranging from wood waste to agricultural residue using water and heat (supercritical water), rather than the enzymes, solvents, and acids traditionally used for extraction. The cellulosic sugars are building blocks for products ranging from fuels and chemicals to industrial additives. The Omno lignin can be used in wood adhesives or other valuable industrial applications, and the crystalline cellulose can be used for food ingredients and personal care applications. As is the case in refining operations, finding downstream product value for each fraction enhances the overall economics and returns of a biorefinery.

Water becomes supercritical when you heat it under high enough pressure. Add enough pressure and heat to liquid water and steam, and the two phases will eventually merge into a new supercritical phase. Supercritical water takes on physical properties of both steam and liquid, but also changes at a chemical level imparting solvation and

the pressure, supercritical water reverts to the liquid and steam phases, allowing for easy recycling of energy and water. The recovered steam can be used to power the plant and run unit operations such as steam explosion, reactors and evaporators. The water streams can be cross-exchanged to recover heat and recycled to other parts of the process. With just water and biomass, the equipment can be made with standard materials of construction. Putting energy and water into the system once and using it multiple times isn’t quite a closed loop system, but it’s a very efficient and sustainable use of those resources.

The capital footprint is advantaged as well. Supercritical hydrolysis has very fast reaction times, on the order of single digit seconds (compared to hours or days for other technologies). This allows for very small and inexpensive reactors. Scaleup risk can be minimised by running multiple reactors in parallel systems, with little impact on overall capital. The system works on massively abundant but recalcitrant feedstocks, such as hardwood and softwood.

The system is designed to produce separate, concentrated, hemicellulose sugar and cellulose sugar streams, as well as a solid lignin stream. Having separated sugar streams allows for maximum flexibility in downstream conversions, with some technologies only capable of using one type of sugar. This allows for fuels or chemicals to be produced from cellulosic feedstock. Also, the lignin stream, having only seen water, retains its chemical functionality and is chemically clean. It is capable of being the higher-value natural chemical substitute that has been investigated for years by paper companies and academia, but which was limited by the quality of the lignin previously available.

*“As is the case in refining operations, finding downstream product value for each fraction enhances the overall economics and returns of a biorefinery”*

catalysis properties that are “tuneable” with pressure and temperature. In many ways, it acts like a solvent and a catalyst, but when you take off the pressure, it’s back to being water.

The use of supercritical water creates many system advantages. When you reduce

The summary effect of all of these advantages is the reason Renmatix partnered with Gevo in December 2018 to develop sustainable aviation fuels. Gevo produces high-performing renewable fuels that it has tested with the US military and commercial carriers such as Alaska Airlines, but is looking to massively scale its production. Using Renmatix's technology, Gevo can expand its feedstocks to include woody plants, which will allow it to produce cost-competitive sustainable fuels in quantities no one has yet been able to achieve.

### 2019 and beyond

In the face of increasingly dire reports about climate change, bioindustrial products will become more and more important. In order to treat



Renmatix uses supercritical water to extract cellulosic sugars, Omno lignin and crystalline cellulose from plant materials

our Earth well and provide truly global solutions that are impactful in the near- and medium-term, we must develop and implement technologies that prioritise economics and volume. We need technologies that can use efficient processes to turn a wide variety of sustainable

feedstocks, including all types of forest feedstocks in the US, which should be RIN-eligible, into cost-competitive, scalable, multi-functional building blocks for chemicals and fuels. The US Department of Energy's 2016 billion-ton report identified a billion tons of excess biomass:

only technologies that can hydrolyse that biomass can get us to meaningful volumes of sustainable fuels, chemicals and ingredients. ●

#### For more information:

This article was written by Fred Moesler, chief technology office at Renmatix. Visit: [www.renmatix.com](http://www.renmatix.com)



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*Biofuels International* speaks with Neutral Fuels' Karl W. Feilder about keeping biodiesel production local and making the most of smart technology

# Keeping it local

**F**ounded in 2009, Neutral Fuels, part of The Neutral Group, converts used cooking oil into biodiesel, a sustainable replacement for fossil fuel-based diesel. Taking the customer as a starting point, the company has constructed clean, efficient working systems to offer higher quality, higher yielding biodiesel, produced at a profit and without subsidies.

Here, *Biofuels International* speaks with founder, chairman and CEO Karl W. Feilder, about the importance of using local sources for biodiesel production, and how smart technologies can help to create highly efficient systems.

## Could you introduce yourself to our readers?

People call me a serial entrepreneur, a techie nerd,

and an environmentalist. I'm happy to own up to the first two but I'm not an environmentalist – I'm just trying to save the planet. I'm also known as a Harley Davidson fan and a rock singer: my band, Sandstörnm, is well known in Dubai.

I'm a British national who brought my family to Dubai in 2009. This is where I established the first licenced biorefinery in the Middle East, Neutral Fuels. In the last decade, my business actions have prevented over 10.5 million tonnes of CO<sub>2</sub> being emitted into the atmosphere by our customers. We use European processing technology to convert waste vegetable oils into EN14214 compliant biodiesel to power the transportation fleets of several corporations.

I'm the first adjunct lecturer

at the Masdar Institute in Abu Dhabi, and have worked as a Catalyst at Hult International Business School in both Dubai and San Francisco. I have a BEng (Hons) in Industrial Engineering and an executive MBA.

Before Neutral Fuels I built five companies to exit via trade sale, and have taken two more to their Initial Public Offering (IPO) on London's stock market. Now I'm driven to inspire the business leaders and entrepreneurs of tomorrow to develop scalable green technologies to save the planet.

## The closed loop model seems to be a key selling point for Neutral Fuels. How does it differ from other systems in the industry?

It's all about local, local, local. I'm not sure many other biodiesel producers have understood that the only sustainable – and moral – way to make biofuel is to make it from waste. Feedstock from a farmer's field almost certainly deprives people of food. On the other hand, any feedstock or biofuel that has been shipped in from somewhere else contributes to climate change. We make our biodiesel in our local refinery from local waste for use by local customers.

That's just one of our differentiators. Another is that in the decade since we started making biofuel in the fossil fuel capital of the world, we've done it without subsidies, carbon credits, or tax incentives. We are probably the cleanest, greenest business you've ever met!

## Have there been any challenges with the model? If so, how did you overcome them?

On the contrary, our only problem is having the capacity to produce enough biofuel to meet demand. We're shortly to commission more production lines.

## Last year, McDonald's announced that it had hit the 10 million kilometre milestone using your biodiesel. Have any other brands chosen to collaborate with Neutral Fuels?

Yes, many other brands, among them DHL, Del Monte, and Anglo American. And corporate interest in biofuel is growing all the time, which is very rewarding because, according to the Carbon Majors Report, just 100 companies have been the source of 71% of the world's greenhouse gas emissions since 1988. By working with businesses we can have the maximum effect on reducing CO<sub>2</sub> in the environment. Governments are also increasing pressure on companies to adopt lower carbon fuels, and biofuel is simply the quickest and easiest way to reduce your carbon footprint.

## What are your thoughts on Dubai's Clean Energy Strategy? How has it benefitted the company?

Dubai is continually proving to the world that it is led by visionaries. The Dubai Clean Energy Strategy aims to produce 75% of Dubai's energy requirements from clean sources by 2050. With 20% of the United Arab



Karl W Feilder, founder, chairman and CEO of Neutral Fuels

Emirate's carbon footprint coming from transportation, we love the fact that we're actively contributing to a sustainable future. It's not yet clear whether the strategy is benefitting us, but I have no doubt it will be because we really have paid our dues in becoming such a viable alternative.

**You've chosen a cloud-based portal system to manage your model. What benefits can a biodiesel model obtain from such a system?**

We always knew we would develop technology to make our fuel delivery really smart. We use IoT (Internet of Things) sensors to track our feedstock, and an iPhone app to track our customers' fuel supplies.

We also install IoT sensors in all the tanks we supply to customers so that we can monitor fuel consumption in real time, prevent wastage

An obsessive focus on technology creates a system that is highly efficient for everyone. It also puts the provenance of our biofuel

forming a complete audit trail. This quantity and chemical quality data is then used to optimise our customer's operations and helps them save on costs. At the end of each month our customers get an analysis of their fuel consumption per vehicle, driver, etc. They love it.

**Does Neutral Fuels have any plans for future development?**

Oh yes! Neutral Fuels achieved profitability in 2012, and since then monthly sales volumes have grown more than 10-fold (a 1,000% increase). We are preparing for IPO in 2023. We plan to franchise this year. There are 50 cities close enough to Dubai to justify a small-scale refinery to produce EN compliant fuel from waste. ●

*“Governments are also increasing pressure on companies to adopt lower carbon fuels, and biofuel is simply the quickest and easiest way to reduce your carbon footprint”*

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